VOLUME XXXVI No. 187 JULY-AUGUST, 1951

ORDNANCE

☆LAND
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Reg. U. S. Pat. Off.

LIEUT. GEN. B. W. CHIDLAW
Chief of the Air Matériel Command

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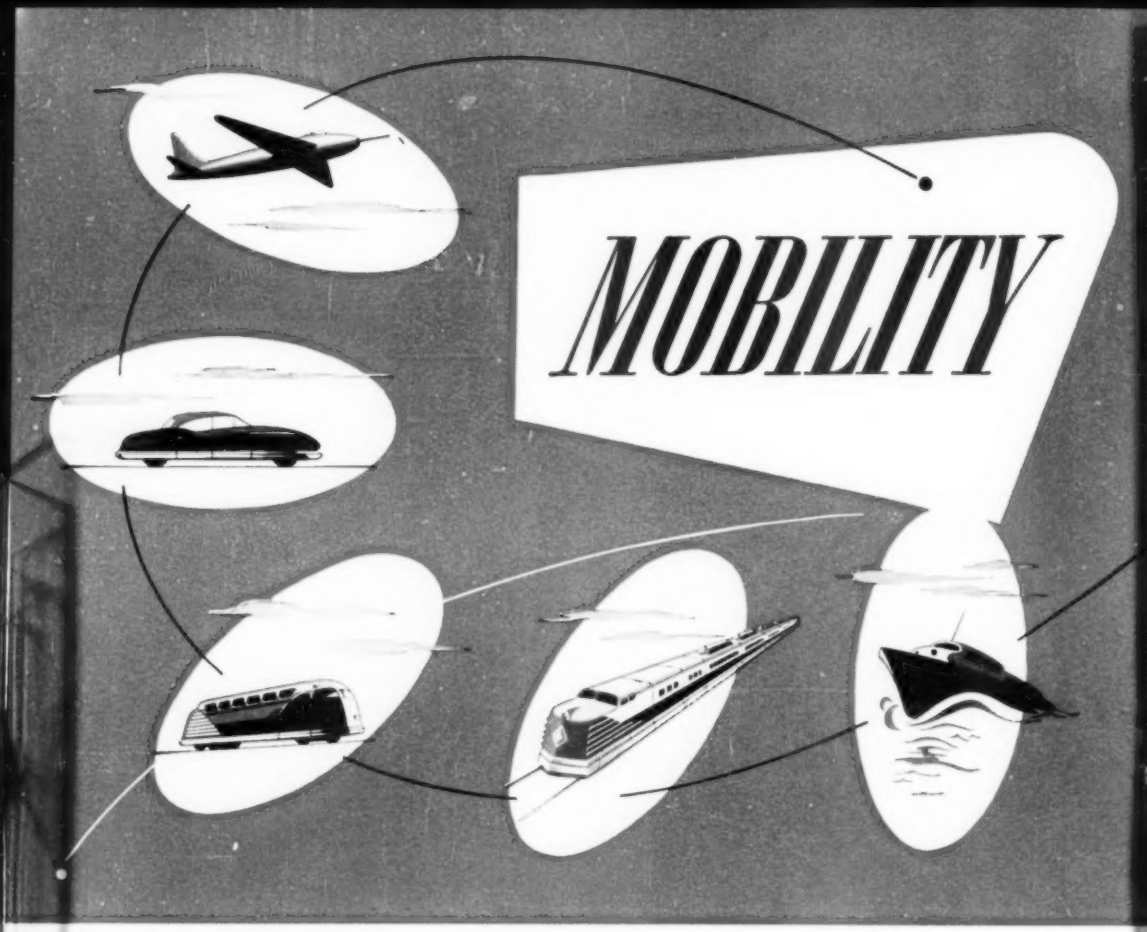

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ORDNANCE

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The Magazine of Scientific and Industrial Preparedness

Vol. XXXVI JULY-AUGUST, 1951 No. 187

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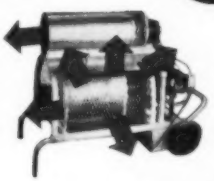
Mail coupon today for complete information about the Model RF and other Silent Glow Portable Heaters.



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68HS1

More news from Chrysler Corporation

Engineering developments that improve the riding qualities of cars, military vehicles, trucks and railroad freight cars

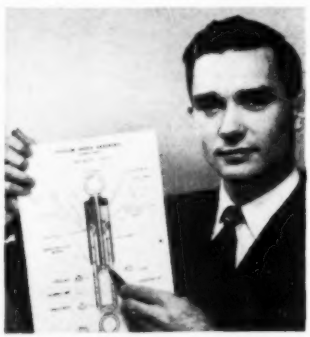
New uses of suspension are doing important things for wheel-borne transportation.

Cars that move along the highways, military vehicles that transport men and equipment, trucks that haul the products of farm and factory, and freight cars rolling on the railroads—all benefit from developments introduced by Chrysler scientific research and engineered production.

This M-37 cargo carrier, *built by Chrysler Corporation, can travel more rapidly and surely over rough country than our World War II cargo carriers. The ride is steadied for men and cargo by new suspension principles, improved springs and heavy-duty shock absorbers that provide extra cushioning power on bad roads and roadless terrain.*

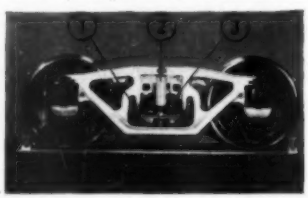
A new and softer ride is now incorporated in military design ambulances and trucks being built by Chrysler Corporation. Often a military ambulance must operate in rugged country where there are no roads. With improved suspension, special springing and new type shock absorbers, jolts and discomfort are minimized as never before.

Another important advance in riding comfort comes from Chrysler's "Oriflow" shock absorber, an exclusive feature on all our new Plymouth, Dodge, De Soto and Chrysler cars, on Dodge ½, ¾ and 1 ton trucks, and all Route Vans. It uses hydraulic principles in a new way to give cushioning power *three times* that of ordinary shock absorbers. On every kind of road, "Oriflow" works in harmony with synchronous springing, shockproof steering and scientific weight distribution to provide a smoother, safer ride.



In this drawing *of Chrysler's new "Oriflow" shock absorber, the engineer is pointing to one of the tubular passages through which cushioning fluid flows. This is a new use of hydraulic principles which helps "Oriflow" absorb bumps by controlling jounce and rebound more smoothly than any design used before.*

For railroad freight cars, which also require protection from shocks along the rails they travel, Chrysler engineers have developed a new "balanced suspension." It absorbs both vertical and lateral shocks gently, so that cargoes can ride steadier and safer.



In this accurate scale model *you see three reasons for smoother "ride." (1) swing hanger which soaks up shocks that come from jolting side motion, (2) unique friction snubber which works with (3) long travel coil springs to cushion vertical shocks and control bounce. Engineered by Chrysler, this mechanism is produced for railroads by qualified equipment manufacturers.*

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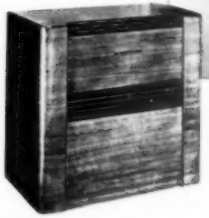

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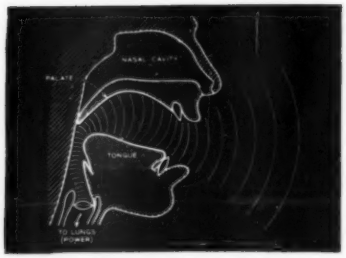
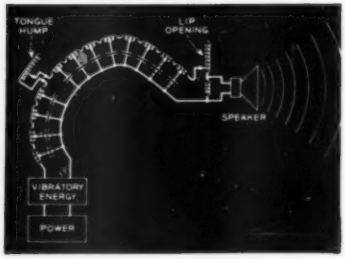


It tells how you talk



The machine at the left is saying "Ah!" It's the new electrical vocal system developed at Bell Laboratories. Top sketch shows human vocal system also saying "Ah!" The electrical model is sketched below it. Energy source at bottom of "tract" can emit a buzz sound, like vocal cord tone, or the hiss sound of a whisper.

No one else speaks exactly like you. Each of us uses different tones to say the same words. To study and measure *how* we make speech, acoustic scientists of Bell Telephone Laboratories built a model of the vocal system.

Electric waves copy those of the vocal cords, electric elements simulate the vocal tract, and, by adjustments, vowels and consonants are produced at pitches imitating a man's or woman's voice.

Using this electrical system, telephone scientists will be able the better to measure the properties of people's voices. Knowing more about speech they can find better and cheaper ways to transmit it.

This is another step in the research at Bell Telephone Laboratories which pioneered the exact knowledge of speech. Past work in the field is important in today's fine telephone service. A still deeper understanding of speech is essential in planning for tomorrow.

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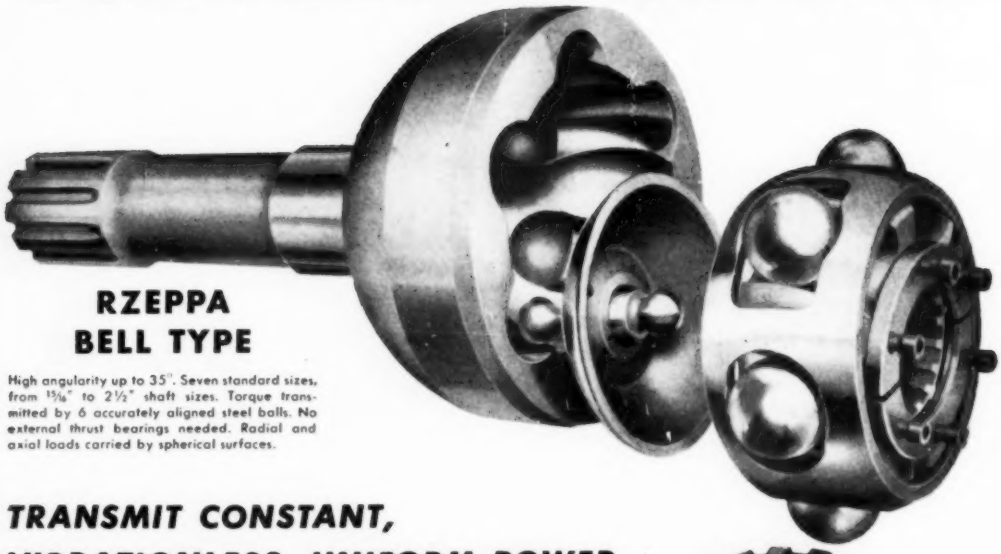

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Bearing race matching
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Diameter
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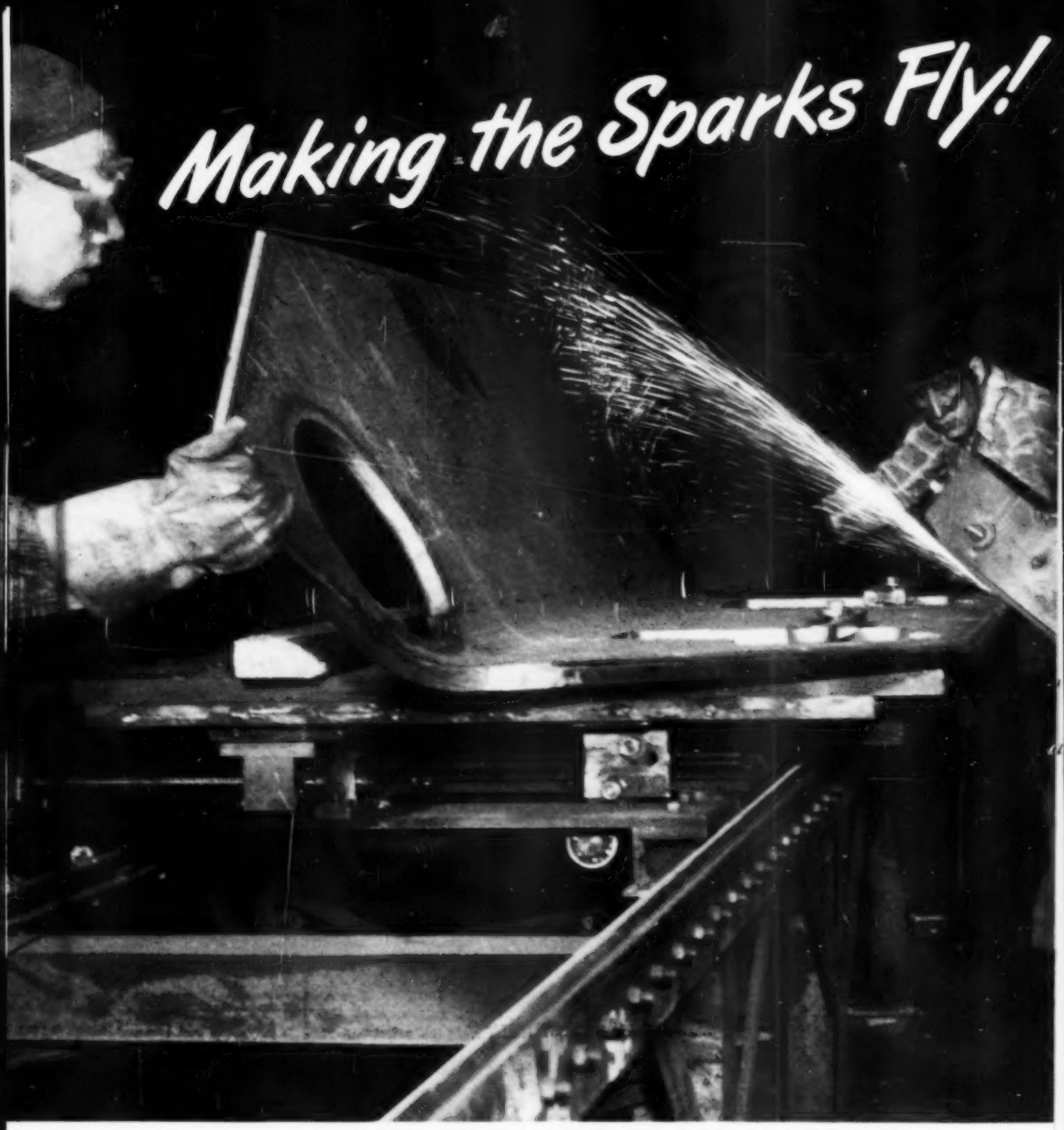
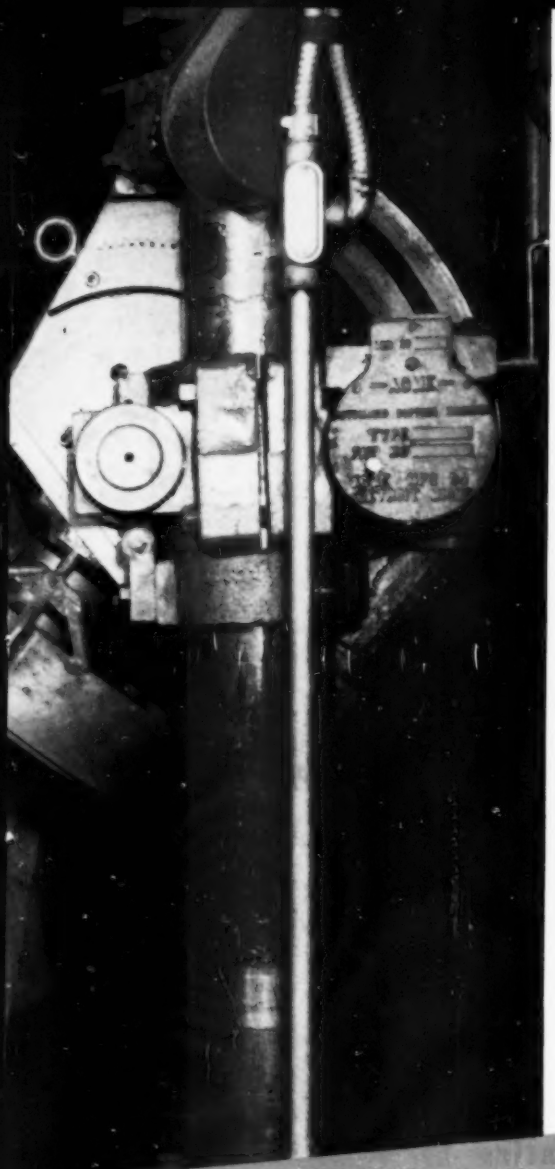


Edge preparation of armor plate.

ORDNANCE



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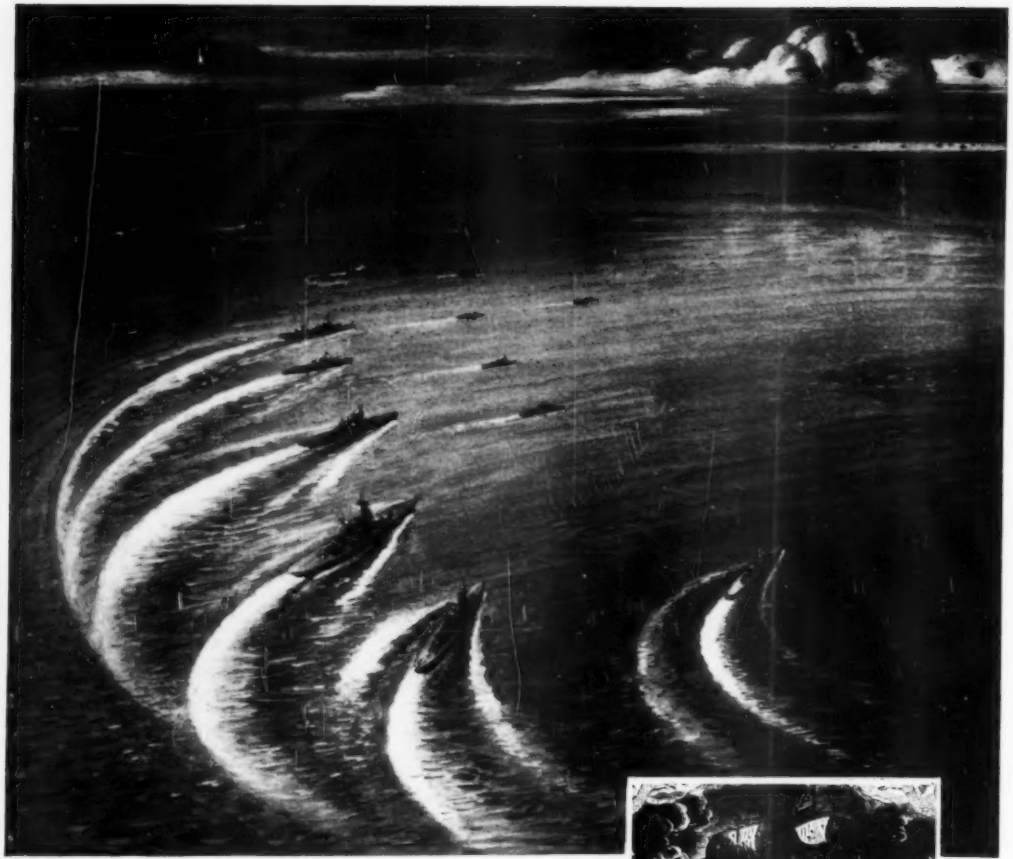
ARMOR PLATE DIVISION • Penobscot Bldg. • Detroit, Mich.

ARMOR PLATE



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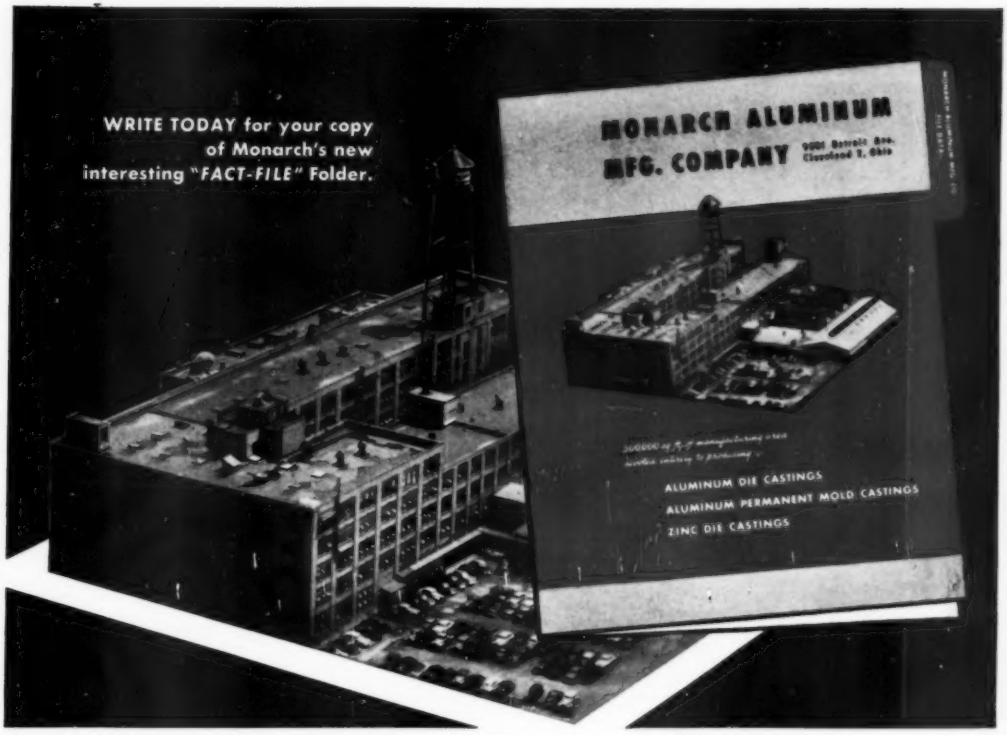

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Monarch's Mobilized Facilities represent an unusual type of integrated service... which few foundries are in a position to offer. These facilities are available for many individual services which may be completely independent of casting requirements.

Monarch's casting production in aluminum permanent mold, aluminum and certified zinc die castings is recognized throughout industry. Monarch offers the obvious benefits of this coordinated service... *in one plant, under one management.*

Monarch's modern trimming and machining methods are capable of meeting unusual mass production requirements within all specifications for quality control.

Monarch's unusual finishing facilities, including complete production of commercial products, offer modern assembly capacity with skilled personnel. Monarch can assume assembly operations to relieve your production problems or eliminate multiple sub-contract operations.

Monarch Offers More Than Just Castings... an integrated service organization worthy of your consideration on your current defense planning problems.

MONARCH ALUMINUM MFG. COMPANY • Detroit Avenue at West 93rd Street, Cleveland 2, Ohio

Thirty vital Bundyweld parts in Reo-built Eager Beaver.

◀ Engine oil tube.

Tough job. Tough truck.

Tough tubing...Bundyweld

The job: Carry five tons a mile a minute, negotiate 60-percent grades, cruise 340 miles non-stop, operate from 65° below zero to 125° above, run in seven-foot-deep water, and more. *The truck:* Army Ordnance's 2½-ton powerhouse M-34 (Eager Beaver) built by Reo Motors. *The Tubing:* Bundyweld, top automotive tubing, in critical fuel, hydraulic brake, lubrication, and other systems.

Bundyweld is the only tubing double-walled from a single strip, with an exclusive beveled edge. It's copper-brazed through 360° of wall contact, extra-strong, leakproof, better performing in automotive products. Bundyweld forms easily, bends quickly to short radii without structural weakening. Its close tolerances reduce rejects, help production roll.

And if those new orders call for an "impossible" bend, you can rely on Bundy. We'll find a way to turn out your part. We'll produce it, too, and rush finished parts to you.

Today, find out what Bundy and Bundyweld can do for your product and production. Write: ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

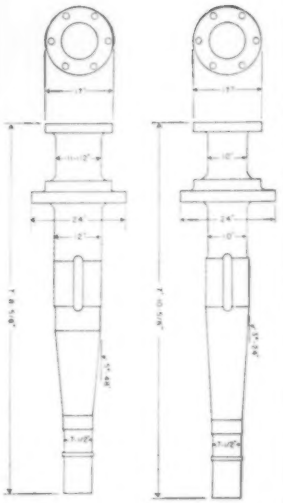
NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

DUCTILE IRON

replaces steel

IN SHAFTING

finished cost { 28% less than that of forged steel shafts



DUCTILE IRON FORGED STEEL

COOPER-BESSEMER CORP., Mt. Vernon, Ohio, adopted ductile iron generator shafts to replace those of forged steel. Corresponding changes in design and dimensions are shown above.

Ductile iron provides unusual advantages. Its tensile strength runs between 83,000 and 94,000 p.s.i. as cast, on test bars cut from a full diameter extension on the small end. Unlike forged steel, which is a product obtained from outside sources, ductile iron shafts are cast as well as machined in the company's own plant. They make possible a low finished cost . . . 28% less than that of a forged steel shaft made to the dimensions shown above.

DUCTILE IRON is a cast ferrous product that combines the *process advantages* of cast iron along with many of the *product advantages* of cast steel.

In less than two years, ductile iron has attained wide acceptance because it offers excellent castability, high mechanical properties and good machinability. Parts cast in ductile iron show superior strength, high modulus and excellent shock resistance.

Typical Current Applications: Axle housing for road machinery, steel rolling mill bearings, chain swivels, diesel cylinder heads, grates, pipe fittings, rails, etc.

AVAILABILITY: Send us details of your prospective uses, so that we may suggest a source of supply from some 100 authorized foundries now producing ductile iron under patent licenses. Request a list of available publications on Ductile Iron . . . mail the coupon now.

INCO

The International Nickel Company, Inc.
Dept. O., 67 Wall Street, New York 5, N. Y.

Please send me a list of publications on: **DUCTILE IRON**

Name _____ Title _____

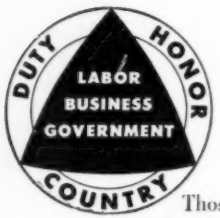
Company _____

Address _____

City _____ State _____

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

DUTY...
HONOR...
COUNTRY...



Those stirring words are on the coat of arms of the Military Academy at West Point . . . symbol and pledge of our future military leaders. Simple, salient words to inspire men to great deeds.

In these perilous days, the significance of DUTY . . . HONOR . . . COUNTRY should be in *all* our minds. Men and women in Labor and Business and Government should carry them in their hearts . . . and pause before arguing over another wage hike, seeking special privileges in defense contracts, or making political bargains aimed at getting the most votes.

Workers and businessmen and politicians may well ponder these words in the hot light of what the future may — or may not — hold.

Daily — through newspapers, radio and television — we watch Labor, Business and Government in disputes of advantages to be gained one over the other . . . while the real enemies of our country press their malicious cause relentlessly throughout the world. Not a pretty picture . . . in fact, pretty small potatoes.

Labor blames Business; Business blames Government; Government blames them right back. And our national dissension is just what the Kremlin ordered. For the Politburo's mouthpiece, Joe Stalin, continues to shout that the greatest Democracy in the world — subjected to enough external and internal pressure — can't protect what it stands for.

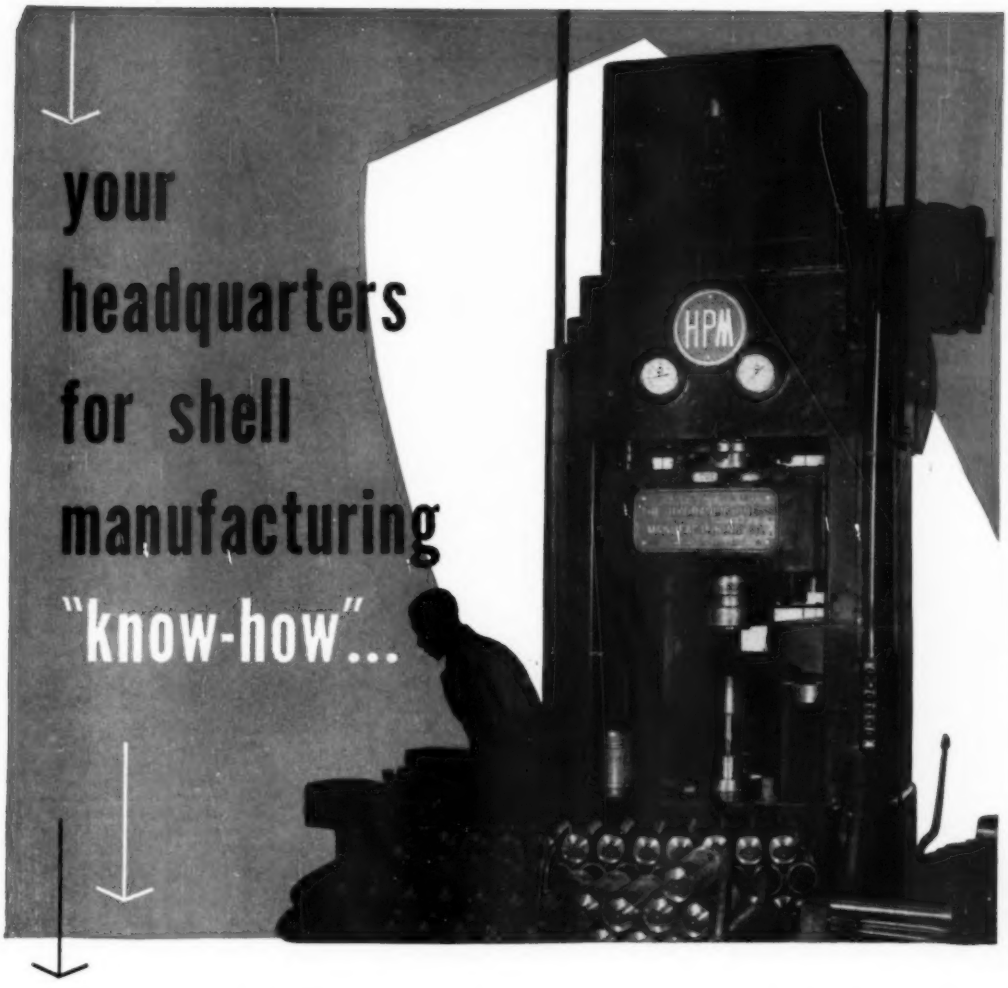
That's arrant nonsense. But our personal quibblings and our selfish interests are helping the big lie become the terrible truth.

To the man at the lathe; to the man whose business is part of our production force; to *every* Government employee (*all* servants of the people) we suggest this:

Nail up the motto DUTY . . . HONOR . . . COUNTRY where it will be seen . . . and lived by.

Walter E. Dittmars

President, The Gray Manufacturing Company
Hartford, Connecticut



● Yes, there's an H-P-M press designed for just about every type of ordnance or ammunition production job. Thru two world wars, H-P-M engineering and manufacturing "know-how" has been applied to every problem that production of shells and ordnance has presented to manufacturers. Result . . . a complete storehouse of information on shell forging, nosing and testing, cartridge case cupping, drawing, tapering and heading. And this vital information covering press equipment costs, estimated production rates, processes to employ, and general die design information is available to you regardless of the size of your operation, for the purpose of preparing bids on shell contracts.

This invaluable information can save you months of personal research and expense. Why not take advantage of H-P-M's "know-how" today and write the Ordnance Equipment Department outlining your plans.

HPM

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Makers of Presses for the Metal Working and Processing Industries • Plastics Molding Presses • Die Casting Machines • Hydraulic Pumps, Valves and Power Units

SERVING INDUSTRY THROUGH HYDRAULICS

Let's Lay It On-the-Line

Mold drag-halves from a jolt-rollover-draw molding machine move along a roller conveyor to receive their copes before pouring. This is a molding floor for medium castings at an A.S.F. steel foundry.

. . . *Quality* Steel Castings Never Quit!

In your armament designing—in your planning of products and production—keep this important fact in mind: cast steel can be *your* answer to a host of vexing problems. World War II proved that, and developments since make fine cast steel more versatile than ever.

As the world's largest producer of cast steel, American Steel Foundries *again* places its outstanding research facilities and expanded high-volume output at the service of the nation. A.S.F. carbon steels, high-tensile steels, and heat- and corrosion-resisting high-alloy steels will help keep America strong.

Our engineers and yours, together, can speed the job at hand. One-piece steel castings, properly designed, accurately cast, and uniform in structure, eliminate the risks of fabrication; save weight and installation time. Let us show you what *quality* means.

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MINT MARK OF ○ FINE CAST STEEL

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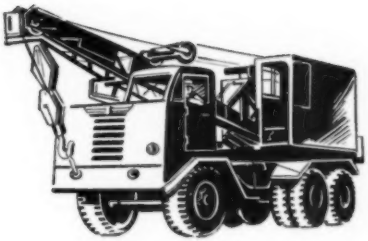
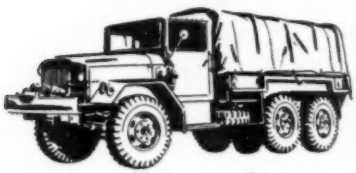
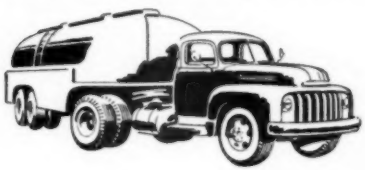


On Any Hauling Job



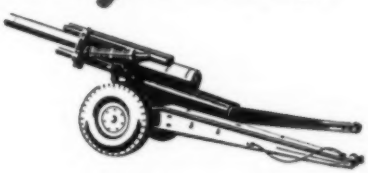
the best brake is AIR...



...the best AIR brake is

BENDIX-WESTINGHOUSE
GENUINE
AIR BRAKES
REG. U. S. PAT. OFF.

Bendix-Westinghouse



Performance Proven in World War II and Accepted by Ordnance Men Everywhere for

- ★ RELIABILITY
- ★ SAFETY
- ★ LESS MAINTENANCE
- ★ ECONOMY
- ★ FASTER SPEEDS . . . GREATER CONTROL
- ★ DRIVING COMFORT

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Don't go any further

For Cast Brass Components and Machined Brass and Bronze Castings

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  Capable of producing large quantity requirements

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  Reputation that results from 80 years' experience in supplying the water and gas utilities, manufacturers in the appliance, industrial, and marine fields, and from producing materiel for the ARMY, NAVY, and AIR FORCE.

Submit your requirements with details, specifications, and delivery for prompt quotation.

MORE THAN 3500 CATALOGED PRODUCTS MANUFACTURED BY HAYS

Here's another of the specialized products designed and produced by HAYS . . . the "ELECTROFLO" Valve.

The "ELECTROFLO" combines the power of electricity with flow pressure in a valve that sets new standards of performance at low cost. Delivers maximum flow . . . handles water or air . . . readily adapted to all types of control devices.

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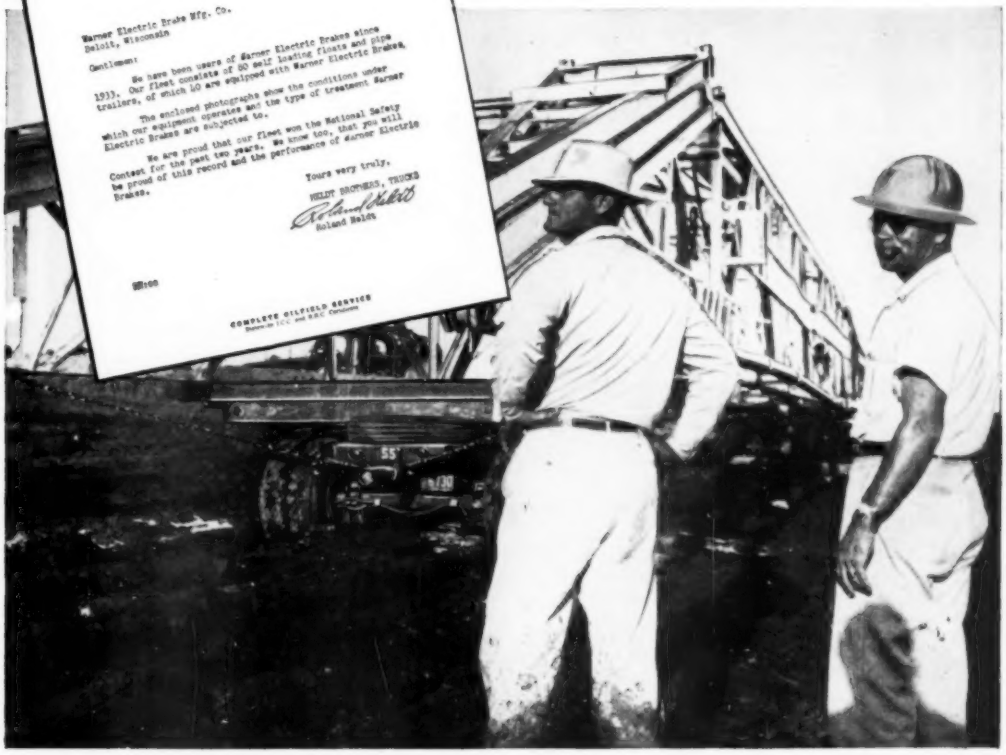
Foundries: Erie, Pa., and Albion, Pa.

HAYS

USER REPORT:

"...users of Warner Electric Brakes since 1933...won National Safety Contest for past two years..."


HELDT BROS., Trucks
December 27, 1950
Warner Electric Brake Mfg. Co.
Beloit, Wisconsin
Gentlemen:
We have been users of Warner Electric Brakes since 1933. Our fleet consists of 60 self loading floats and pipe trailers, of which 40 are equipped with Warner Electric Brakes.
The enclosed photographs show the conditions under which our equipment operates and the type of treatment Warner Electric Brakes are subjected to.
We are proud that our fleet won the National Safety Contest for the past two years. We know too, that you will be proud of this record and the performance of Warner Electric Brakes.
Yours very truly,
HELDT BROTHERS, TRUCKS
Roland Heldt
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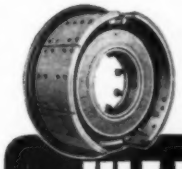
COMPLETE OILFIELD SERVICE

LOOK at that muck and mire! That's the stuff that's sheer murder on men and machines — the stuff you've got to expect when you go after oil — because oil is where you find it. Just ask the Heldt Bros., who specialize in going where oil is — and roads just ain't. That means, too, that trailer brakes must withstand every kind of severe weather and road condition. So take a tip from Heldt Bros. — get Warner Electric Brakes.

Warner Electric Brakes give lightning-fast action with an infinite degree of braking control, plus low-cost installation and maintenance. There's full clearance under the tractor and trailer — nothing to get knocked off or leak — no exposed braking equipment — no rods to rattle — no tubing to split — only simple wiring to each wheel.

For full information see your nearest Warner Electric Brake dealer — or write:

WARNER ELECTRIC BRAKE & CLUTCH CO.
DEPT. O, BELOIT, WISCONSIN



Revolutionary!
Warner Electric Brakes of 2-shoe construction in sizes 16½" x 5", 16½" x 6", and 16½" x 7". A really new concept of super-stopping power. Ask about them.

WARNER
THE ORIGINAL AND PROVEN
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Heavy Duty Trailers

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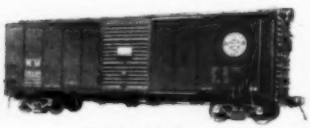
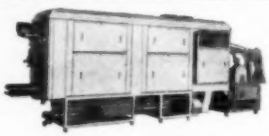


Steel Freight Cars



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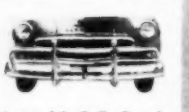
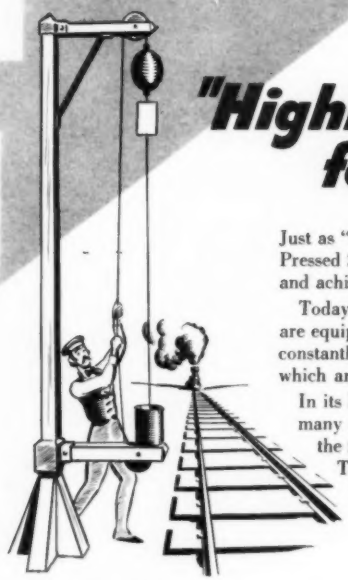
Stainless Steel Milk Strainers

The new Cellular Laminated Unicel Refrigerator-Box Car



Automobile Grille Guards



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Just as "highball" means a clear track to the railroader, Pressed Steel Car Company stands for constant progress and achievement in service to American industry.

Today, Pressed Steel Car's broad production facilities are equipped and manned to meet the urgent need for a constantly changing variety of industrial products, some of which are shown here.

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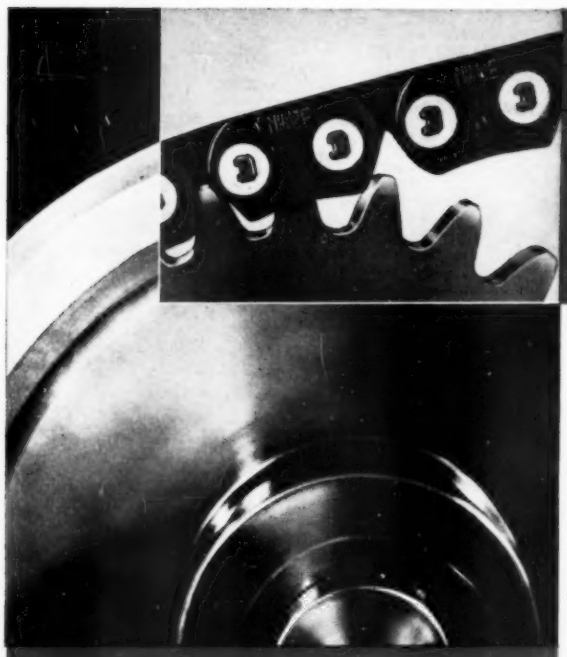
Sensational, new Morse HY-VO (TRADE — MARK) Drive transmits more horsepower at higher speeds than any other type of drive!

M-PT



- More horsepower per inch of width
- Cuts cost-per-hour by as much as 50%
- Smooth and vibrationless as a belt
- Positive as a gear with the strength of steel
- Up to one-third longer service life

Single-drive HY-VO units are capable of transmitting 5000 H.P.

THE new Morse HY-VO Drive literally revolutionizes high-speed, heavy-duty power transmission. It combines—for the first time—the ruggedness and positive action of a gear with the smoothness and lack of vibration of a belt.

Entirely new design principles are used in the HY-VO Drive. Vibration and destructive linear pulsations are virtually eliminated, allowing the HY-VO Drive to operate at tremendously increased rotative speeds, using drives of much narrower widths. It opens the way for transmitting much higher horsepower from smaller, more economical, high-speed engines.

Due to the shortage of materials and production facilities, orders for HY-VO Drives must carry a priority rating at the present time.

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MECHANICAL *POWER TRANSMISSION* PRODUCTS

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ROCKETS • SHELLS • FUSES

and other ammunition metal components assures the armed forces of highest quality, delivery as promised and fair price.

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CONTINENTAL RED SEAL POWER

...IT'S THE...

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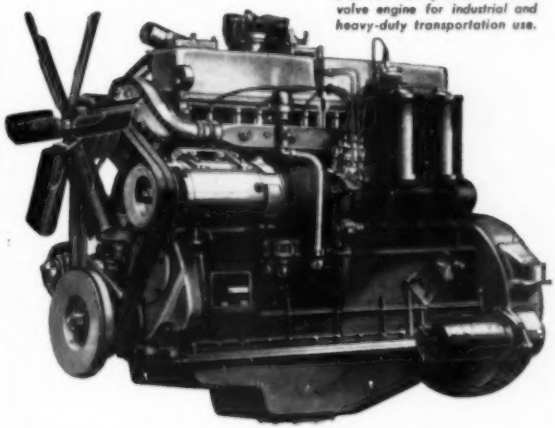
Red Seal power is standard in leading makes of equipment for industrial, farm and transportation uses. Red Seal engines and power units for a wide range of applications are available through dealers from coast to coast.

S-6749—Six cylinder overhead-valve engine for industrial and heavy-duty transportation use.



When choosing mechanized equipment for industry, farm or transportation, pay special attention to the power plant. That's good advice at any time, and extra good today. The manpower shortage has hammered home the need for dependable machines—and even the best is only as dependable as its source of power. . . . The presence of a Red Seal engine in vehicle or specialized equipment is an added assurance of user satisfaction over the years, for Continental Red Seal is truly specialized power. Continental's policy ever since 1902 has been to build each engine expressly for its work. Red Seal commercial models, ranging from ¾ to 270 horsepower, are built to more than 1,000 different specifications. And every model is engineered as an integral part of the equipment which it powers. . . . You can place full confidence in the product of the manufacturer who has chosen Continental Red Seal as the heart of his machine.

FACTORY-AUTHORIZED SERVICE AND GENUINE CONTINENTAL RED SEAL PARTS AVAILABLE FROM COAST TO COAST

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Now STANDARDIZED

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If *you* have a shaft sealing problem, Gits experience in these and many other specific applications can prove of great and immediate value to you.

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*Cartridge Seal . . . pressure balanced . . . requiring only 25% more space than lip-type seals.

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The Standard For Industry For Over 40 Years

ROCKRITE TUBING

Has High Surface Finish

BEFORE MACHINING!

PROVED BY PROFILOMETER RATINGS AS LOW AS 5 MICROINCHES

You can trim machining costs of ring shaped and cylindrical parts with Rockrite Tubing because it reaches your plant with close tolerances and smooth surfaces. The reason? This tubing is sized by a distinctively different process:

• Dies compress the metal against a mandrel, tending to iron out small irregularities on both the inside and outside surfaces. The metal flows from high spots in the same manner as when it is forged.

• A certain amount of planishing action also takes place on the inside surface of the tube as it elongates under the pressure of the dies and creeps forward while in contact with the mandrel.

• In no part of this operation is there any action which can produce longitudinal scratches. The metal is not drawn through a die and over a mandrel.

The proof of high surface finish? Profilometer readings recently taken on samples of Rockrite Tubing exhibiting superior finish show a range of RMS values of 5 to 55 microinches. In the manufacture of parts such as hydraulic cylinders this superior finish means substantial cost-savings well worth investigating.

HOW DO YOU SCORE? Do you know the three requirements essential for tube accuracy and lower-cost machined parts? New bulletin tells answers . . . gives more facts and figures on close-tolerance Rockrite Tubing. Send for your copy today.

ROCKRITE TUBING

ROCKRITE saves more than any other tubing

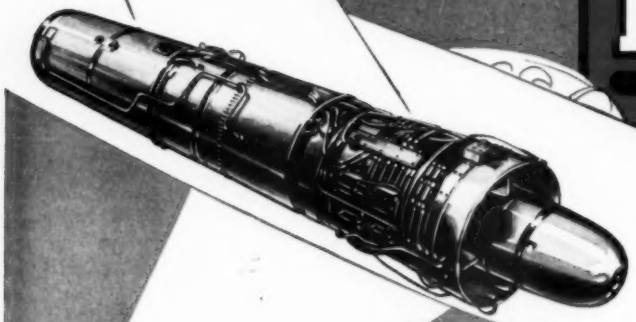
- **Higher cutting speeds**
- **Tools last longer between grinds**
- **Work-surface finishes are better**
- **Machined parts have closer tolerances**
- **Stations on automatics are often released for additional operations**
- **Extra-long pieces available—less downtime for magazine stocking and fewer scrap ends**
- **Closer tolerances often eliminate necessity for machining on outside or inside**

TR-110

•TUBE REDUCING CORPORATION •WALLINGTON, NEW JERSEY

Another First for...

N-A-X
ALLOY STEELS



The use of N-A-X ALLOY STEEL in Aircraft Gas Turbines saves up to 50 per cent of critical Stainless Steel.

Conservation is possible – without sacrifice with use of N-A-X ALLOY STEELS

With the demand for greatly increased quantities of the critical and strategic Stainless Steels used in Jet Engines intensified by the acceleration of the building program, the Air Force requested the producers of these engines to seek *suitable* material with less critical alloy content to replace the Stainless Steel for certain moderate temperature application in these aircraft gas turbines.

The steel selected had to be of low-alloy content with high strength and good welding characteristics. Ordinary low carbon steel did not meet the requirements because of its low tensile properties and the fact that it could not be satisfactorily welded by the inert arc process, which is widely used in aircraft gas turbine manufacture.

The data available from tests made on several weldable low-alloy, high-strength steels indicated that N-A-X ALLOY STEEL was the most satisfactory of the group — *its selection followed.* Unlike other possible substitutes, N-A-X ALLOY STEEL has good low temperature impact values, maintains its higher strength and is not subject to temper brittleness in the wide operating temperature range required of the steel for this purpose — from a low of −70°F. to +800°F.

The use of N-A-X ALLOY STEEL for this application has cut the amount of Stainless Steel required in half. This is of considerable importance to the Air Force.

GREAT LAKES STEEL CORPORATION

N-A-X Alloy Division — Ecorse, Detroit 29, Michigan

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St. Louis, Mo. "I get my work out twice as fast with my IBM Electric. Better carbons and nicer results, too."

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New Brunswick, N. J. "My secretary turns out letters I'm proud to sign, proud to have represent me and my company. She types so much faster, too, that now she can relieve me of much of my regular routine work."

* *Excerpts from unsolicited letters.*

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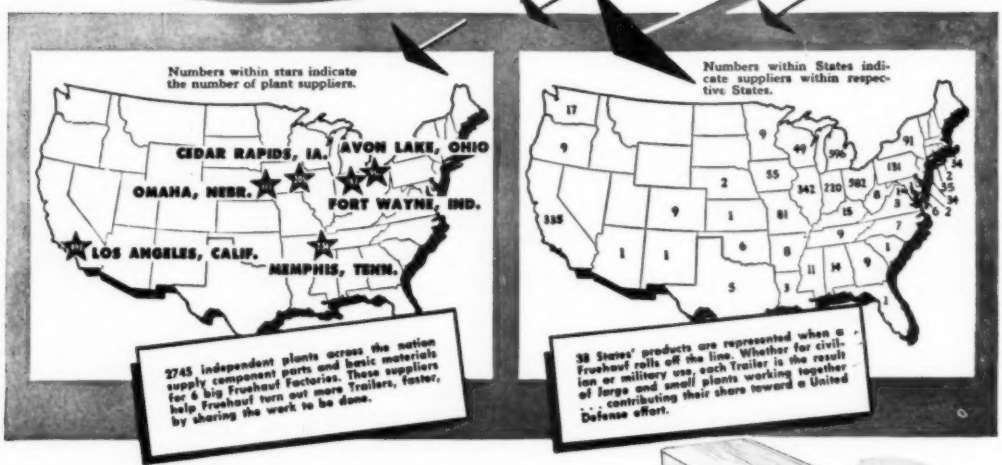
*Address*_____

2745 Plants in 38 States
SHARE THIS
ONE BIG DEFENSE PRODUCTION JOB



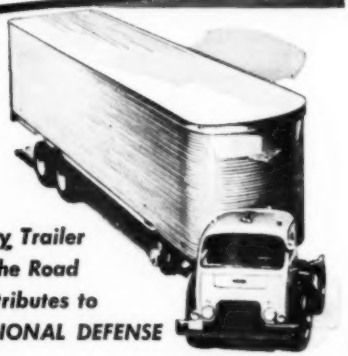
FRUEHAUF has received a number of important defense contracts because we have the ability and facilities to handle them. This is the way our government spreads the work to *many* plants, large and small, in a united effort to build the Trailers needed — faster!

As a matter of fact, 2745 companies share in the Fruehauf production job. 38 states benefit with more jobs for their communities.

Without the help of these many smaller manufacturers Fruehauf production lines just wouldn't operate. With their aid, we have been able to establish, month-after-month, new all-time production records.

The Fruehauf defense production picture is being duplicated by many other companies across the nation. It's a perfect example of the manner in which large and small businesses are working *together* to do a *real* defense production job.

FRUEHAUF TRAILER COMPANY, DETROIT 32, MICHIGAN.



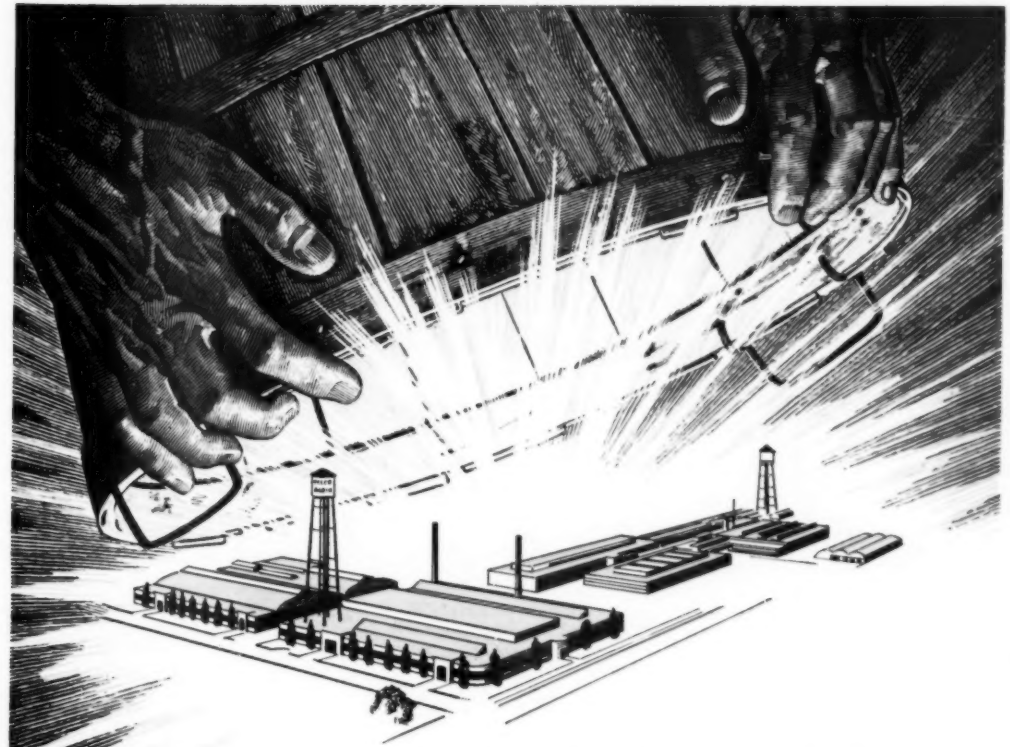
Every Trailer on the Road Contributes to NATIONAL DEFENSE

Whether the load is Tank parts or tomatoes every Trailer is contributing to National Defense . . . supplying industry, feeding men and delivering finished products.

Almost everything you eat, wear and use is delivered all, or part of the way, in Trailers. They are a vital link in our nation's transportation system, and a necessity for fast, economical military transport.

EVERYBODY *Shares in a* UNITED *Defense Effort*

FRUEHAUF *Trailers* "ENGINEERED TRANSPORTATION"



WE'RE LIFTING THE BUSHEL BASKET— AND LETTING OUT OUR LIGHT!

Probably you didn't know it because we haven't told you. BUT—for the past five years we've been building car and truck radios for General Motors. In 1950 alone we built nearly 2,000,000 radios for practically all types of vehicles. Our production tops that of any other car radio manufacturer.

Since we stopped making radio and electronic equipment for the armed forces during World War II, we've concentrated on making our facilities the largest and our products the finest in the industry. Unlike most others, we're not just an assembly plant. We make practically all the parts that go into our products. Our design and research engineers are tops in their field. Our laboratory and production equipment is the finest that can be obtained.

With our vast experience, our facilities, engineering know-how, our productive manpower bigger and better than ever before, we believe we can be of service to our country. We are ready to go to work immediately for national defense and count it a privilege to volunteer for service.

Delco Radio

DIVISION, GENERAL MOTORS CORPORATION
KOKOMO, INDIANA

60

WIREBOUND BOX PLANTS

are ready to serve you!

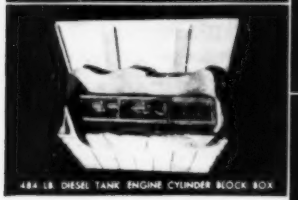
ALL FULLY INFORMED ON SPECIFICATIONS
AND REQUIREMENTS OF ALL GOVERNMENT BRANCHES

Strategically located to serve suppliers of all government services, Wirebound Box manufacturers are in excellent position to meet your shipping container needs. Parts boxes, equipment crates, over-packs and food containers are but a few of the multitude of uses for which Wirebound containers are adaptable. Wirebound manufacturers are informed, experienced and technically trained to design, produce and pre-test scientific containers for each use. Make it a point to consult your nearest Wirebound supplier or write for full information.

Wirebound Box Manufacturers Association
Room 1163, 327 South LaSalle Street, Chicago 4, Illinois

CYLINDER BOX

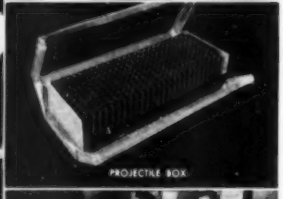
IMMERSION HEATER BOX


484 LB. DIESEL TANK ENGINE CYLINDER BLOCK BOX

FIELD RANGE CRATE

CHEMICAL BOMB BOX

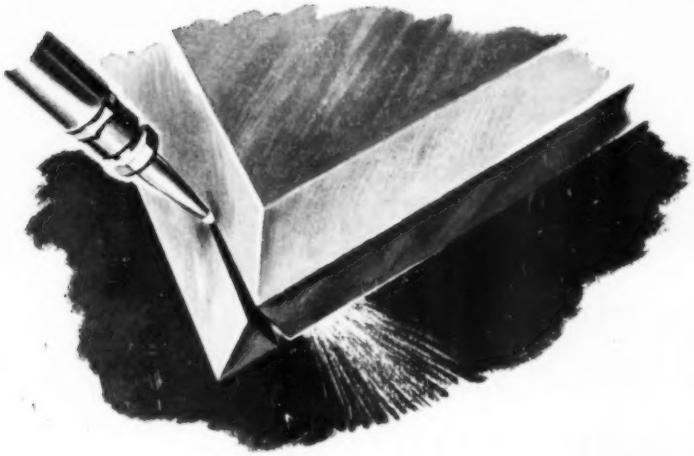
TYPICAL WIREBOUND OVERPACK


PROJECTILE BOX

PRACTICE BOMB CRATE

Wirebound
BOXES & CRATES
Users names on request

Now! Truly accurate plate-edge preparation to ± 1/16" tolerance *with a flame!*



It's true! Acetogen Fabricators are doing the job that industry thought couldn't be done. They're cutting all thicknesses of armor plate—square edge, bevel edge, multi-bevel edge—so smoothly and accurately that plates fit the welding jig without grinding or finishing.

Right now, the Acetogen Process is speeding vital defense work in the Philadelphia plant of Henry Disston & Sons, Inc. Disston men are as amazed at the tremendous output of Acetogen Fabricators, as they are enthusiastic over the precision of their work.

The Acetogen Process will increase production for you, too. We have the organization and flame-cutting "know-how" together with the gas and nozzles; we will act either as consultants, or as sub-contractors—doing the entire job in your plant. *We invite your inquiry.* Acetogen Fabricators, Inc., 822 Commercial Trust Bldg., Phila. 2, Pa.

ONLY THE ACETOGEN PROCESS OFFERS THESE STARTLING ADVANTAGES

- Armor plate of all thicknesses flame-cut to ± 1/16" tolerance!
- The flame-cut plates are ready for welding without grinding, finishing, bridging, or beading!
- Single- and multi-bevels are as easy to flame-cut as square-edges!
- Flame-cut plates have "feather" edges . . . surfaces have sufficiently low Brinell to allow machining.
- No heavy investment needed; the Acetogen Process utilizes standard, readily-available, low-cost equipment and tools.
- Experienced flame-cutters become qualified Acetogen operators within a few days.

ACETOGEN FABRICATORS, INC. *Originators of precision flame-cutting*

1917—1919

1941—1946

Now, As Always, PREPARED and PRODUCING!

Since World War I, Timken-Detroit has played a major role in the modernization and mechanization program of the United States Armed Forces.

At the outbreak of World War II, Timken-Detroit's research and development program—carried on continuously since 1919 in cooperation with Armed Forces personnel—helped to make possible the immediate mass production of modern military vehicles.

Timken-Detroit did not relax with victory. Realizing the high cost of unpreparedness in a national emergency, Timken-Detroit moved ahead with new developments in axles, brakes, transmissions, transfer cases and other components for military vehicles. Today, Timken-Detroit is *out* of the blueprint stage—*producing for peace!*

1951

WORLD'S LARGEST MANUFACTURER OF AXLES FOR TRUCKS, BUSES AND TRAILERS

PLANTS AT: DETROIT AND JACKSON, MICH. • OSHKOSH, WIS. • UTICA, N. Y.
ASHTABULA, KENTON AND NEWARK, OHIO • NEW CASTLE, PA.

TIMKEN *Detroit* **AXLES**

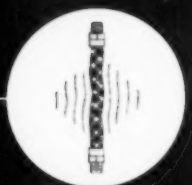
A PRODUCT OF THE TIMKEN-DETROIT AXLE COMPANY
DETROIT 32, MICHIGAN

The Accepted D A Standard

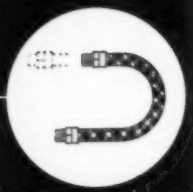
TRADE MARK REGISTERED

Titeflex

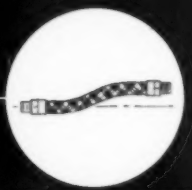
ALL-METAL FLEXIBLE TUBING



FOR VIBRATION



FOR FLEXING



FOR MISALIGNMENT

You can't beat Titeflex for conveying liquids, gases or semi-solids when there is any kind of motion present. Here are the facts about this better-built flexible tubing:

- ★ Made in five metals—brass, bronze, stainless, Monel, Inconel.
- ★ Types and sizes to withstand heat to 1550°F.
- ★ Types and sizes for pressures up to 6800 psi.
- ★ Supplied with any type of fittings—standard or special.
- ★ Stays flexible and stays tight under severe conditions.

There's a style of Titeflex for almost every need—and Titeflex is *all-metal*, to last longer in any kind of service.

Write for complete catalog.

Titeflex, Inc.

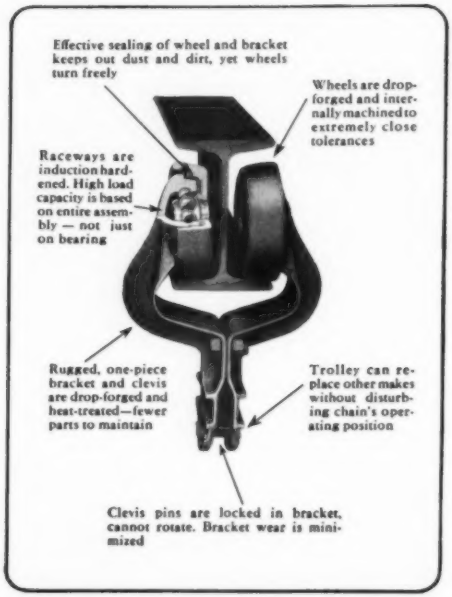
512 FRELINGHUYSEN AVENUE NEWARK 5, NEW JERSEY

TITEFLEX FILLS TUBING REQUIREMENTS TO A... T

When you buy TROLLEY CONVEYORS...

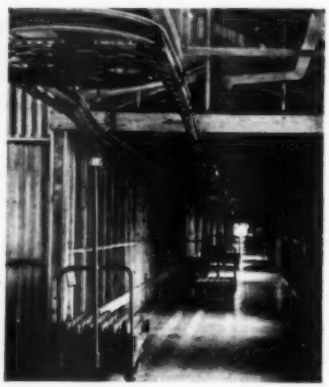
LINK-BELT GIVES YOU BOTH!

Superior components plus engineering ingenuity


Effective sealing of wheel and bracket keeps out dust and dirt, yet wheels turn freely
Wheels are drop-forged and internally machined to extremely close tolerances
Raceways are induction hardened. High load capacity is based on entire assembly — not just on bearing
Rugged, one-piece bracket and clevis are drop-forged and heat-treated—fewer parts to maintain
Trolley can replace other makes without disturbing chain's operating position
Clevis pins are locked in bracket, cannot rotate. Bracket wear is minimized

These heavy shells have ridden through a paint spray booth and are now drying on a Link-Belt Trolley Conveyor.

This Link-Belt Overhead Trolley Conveyor conveniently delivers 90-mm. shells along their finish-turn production line.



Shells travel in large quantities over long distances upon this Truck-Tow adaptation of an overhead trolley conveyor.

Travel up, down and around at synchronized speeds. Straight-line production regardless of physical layout. Saving of floor space. Release of manpower for productive jobs.

You get all these outstanding production advantages with any well-engineered overhead trolley conveyor. But you get more—much more—when you specify Link-Belt.

Not only does Link-Belt make the most popular, the most advanced trolley on the market—you also tap industry's greatest source of materials handling and power transmission experience.

Put quality manufacture plus engineering ingenuity to work for you. Our specialists will work with you and your consultants . . . help you set up smooth, steady, straight-line production in your plant.

LINK-BELT

OVERHEAD TROLLEY CONVEYORS

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 12,340-A

Connector Problem?

...We'll take it from HERE

Good ideas for electronic circuitry sometimes run afoul of connector problems. Maybe existing connector units won't hold air pressure gradients, won't stand the heat, aren't rugged enough for the job. Or maybe it's a question of altitude, or under-water application. But if you can sketch the circuit, we'll take it from there. We've engineered so many special connectors, solved so many "impossible" problems, that whatever the requirements are, we can usually provide the answer.

Lightweight actuators for any requirement.

Job engineered, welded-diaphragm bellows.

Flexible conduit and ignition assemblies.

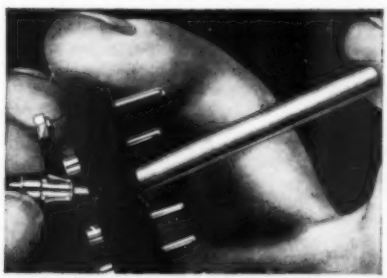
Aero-Seal vibration-proof hose clamps.

WRITE TODAY for specific information, or send us your sketches. We'll forward recommendations promptly.

BREEZE
Special CONNECTORS

BREEZE CORPORATIONS, INC.

41 South Sixth Street Newark, New Jersey



Removable pins in Breeze connectors speed soldering, save time, trouble. Pins snap back into block.

F84, USAF

What it takes to send one jet into action!

12,625 lbs. Aluminum, Steel, other Metals

7,000 ft. of Electrical Wiring

1,500 ft. of Varied Tubing

515,000 Separate and Distinct Parts

13,500 Separate and Distinct Tools

20,000 Skilled Man Hours

A giant jig-saw puzzle, yes, but it's solved *every day* by American industry. Thousands upon thousands of intricate parts are produced, assembled and fitted into a perfect finished product. Each part fits and functions smoothly because in America *skill* and *speed* pay off.

It pays a manufacturer to build a better part, a better product. It pays a worker to do a better job... to take pride in it. Jet or "Jig-saw" the finished product is *bound* to be better.

Owing to security restrictions all figures are approximate

AMERICAN MACHINE & FOUNDRY COMPANY

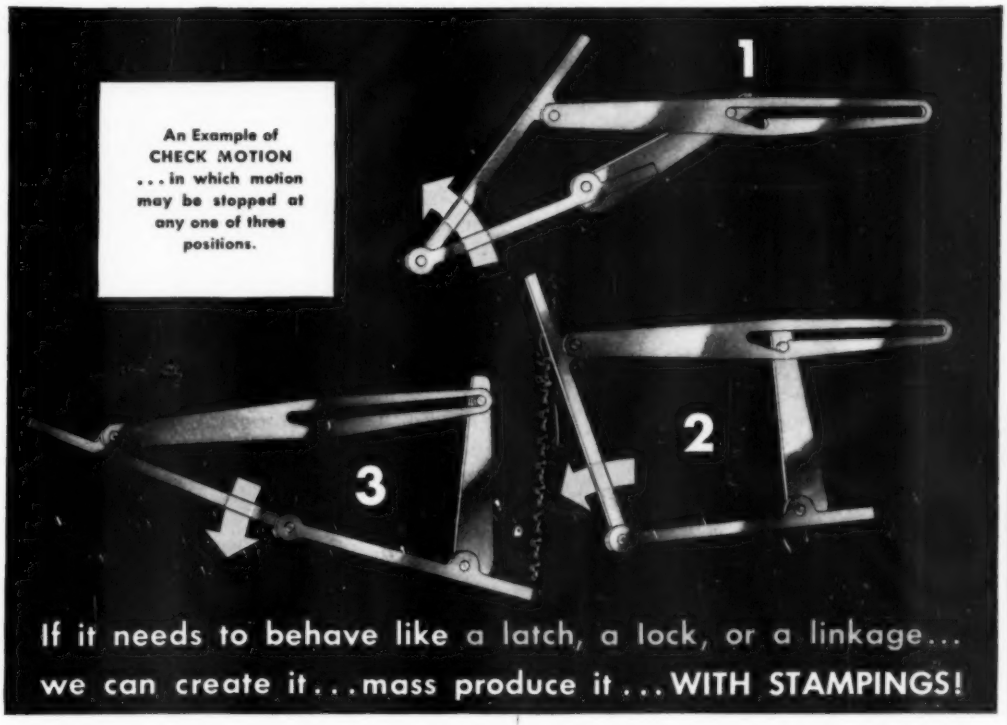
Executive Offices, 511 Fifth Avenue, New York 17, N. Y.

AMF does it better—automatically!

CREATORS AND PRODUCERS OF ELECTRONIC AND MECHANICAL EQUIPMENT

For the armed services: Antennae and drive units for radar systems • automatic loaders for antiaircraft and naval artillery • elevating and azimuth mechanisms cooling fans for Army tanks • airplane parts • mobile ovens • electronic training devices naval ordnance • various special military developments.

For industry: Tobacco processing equipment, cigarette and cigar making machinery bakery ovens and machinery • automatic pinspotters, bowling equipment and supplies DeWalt power saws • Lowerator Dispensers • batch and continuous mixers • stitching machines • Wahlstrom automatic chucks and tappers. • Union bakery equipment.


An Example of
CHECK MOTION
. . . in which motion
may be stopped at
any one of three
positions.
1
2
3
If it needs to behave like a latch, a lock, or a linkage...
we can create it . . . mass produce it . . . WITH STAMPINGS!

Perhaps your product requires a carefully-engineered motion device to enhance its safety or improve its performance.

We produce such devices to very close tolerances with STAMPINGS... and by modern mass production and assembly techniques, we can keep the cost unusually low.

That's why you'll find Standard locks and latches on many of the new model cars. It's a reason why you may want to investigate our facilities further. Why not send for our new booklet "We Make Motions" — which explains in more detail how we can help solve your "motions" problem.

THE REID DIVISION OF *The Standard Products Co.*

THE MARK OF A SUPERIOR PRODUCT

DEPT. E, GENERAL OFFICES: 2130 WEST 110 STREET • CLEVELAND 2, OHIO

WE MAKE MOTIONS

Even the toughest baby must be coddled

Rough and tough as tank gun-mounts are, they need all the protection they can get from the ravages of water, sand, and snow.

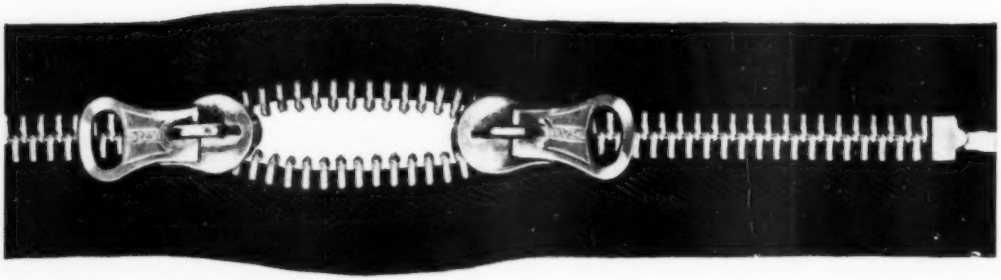
Vital parts must be covered—but in such a way that they can be stripped down for action in a matter of seconds.

That's why, during World War II, the government called on Conmar to supply durable, weather-resistant zippers—like the #7 mesh shown below. Four times, the Conmar Company won Army-Navy E's for zippers which met the most rigid military requirements. Because Conmar zippers are specifically designed to run perfectly under all conditions—they're rust-proof, water-repellent, mildew-resistant, precision-engineered to take severe cross-pull strain. They inter-mesh smoothly, lock firmly, never slip . . . yet always run smoothly and quickly when it's time to take the wraps off.

When ordering zippers in accordance with specifications (QMC 100-31, AN-229, or V-F-106), remember the name CONMAR.

Conmar zippers

Conmar, Newark 1, N. J. Direct N. Y. Phone: REctor 2-9800
Branches: Atlanta · Baltimore · Boston · Chicago · Cincinnati · Cleveland · Dallas
Los Angeles · Minneapolis · Philadelphia · Rochester · St. Louis · San Francisco



HOKE AND USA PRECISION GAGE BLOCKS

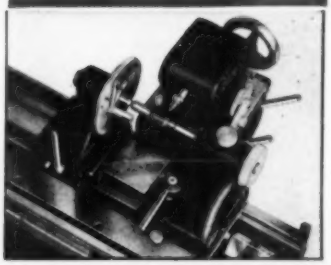
BASIC STANDARDS OF PRECISION. Used universally for setting and checking working gages and inspection gages, for checking setting masters, and for setting comparator-type gages and instruments.

STANDARD MEASURING MACHINE

The Standard of Measurement in the best equipped shops. Reads directly to .00001". A completely self-contained instrument having an integral master bar and accurately controlled measuring pressure.

ELECTRO-MECHANICAL LEAD TESTER

A direct-reading instrument for checking lead of straight and taper external threads. Lead measurements are read directly to .00001".



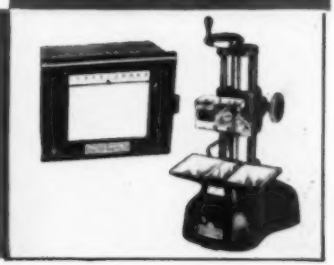
PRATT & WHITNEY
BASIC MEASURING EQUIPMENT
...Foundation of Accuracy in the Control of Quality

ELECTROLIMIT UNIVERSAL INTERNAL COMPARATOR

An accurate, dependable instrument for checking diameter, out-of-round, taper, and bellmouth of cylindrical ring gages and other close-tolerance internal and external cylindrical surfaces.

ELECTROLIMIT MILLIONTH COMPARATOR

Provides an accurate, dependable method for checking gage blocks to the millionth of an inch. Gives direct millionth readings on scale, and permanent recordings of measurements on chart.



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First Choice for

ROCKY ROAD WORK near Fort Belvoir, Virginia. This "Cat" No. 12 Motor Grader has the stamina to take it in stride—and a tough blade to stand up under the beating dished out by rocks.

DAM CONSTRUCTION calls for the use of motor graders that have the balanced power to step right along with full load. This "Cat" No. 12 Motor Grader has the situation in hand on the Farmington Dam near Farmington, California. Contractors: Morrison-Knudsen Co., Inc., Los Angeles.

HIGHWAY RELOCATION and widening in hard clay and rock along the Columbia River and Cascade Mountains on No. 30, forty-five miles east of Portland, Oregon. This "Cat" No. 12 Motor Grader is one of a fleet of "Cat" equipment on the 550,000 yd. project. Contractor: Peter Kiewit Sons Co., Longview, Washington.

tough jobs

You've got the whip hand over any blade work when you've got a motor grader with *stamina*—with properly balanced *power*—and maximum *smoothness* of operation over rough terrain. It can take tough assignments without faltering. And it will do more and better work. That's why the "Caterpillar" Diesel No. 12 gets the nod on big construction jobs.

Stamina, long life with minimum downtime, is inherent in "Caterpillar" Graders. The proof's on record. Over 99% of all "Cat" Motor Graders ever built are still in use—and some are 20 years old.

The "Cat" No. 12 is rated at 100 hp.—and that power is *all* available at the blade. Just as important, it is *balanced* with the correct weight and working speeds for maximum production.

And the oscillating tandem drive climbs over ditches and rough terrain for smoother operation than is possible with single-axle drives.

All blading work looks pretty much alike to the No. 12. An essential tool for building and maintaining roads, dams and airports, it has the strength for rough grading, the precision for finish grading, and the maneuverability to work wherever vehicles travel.

For *stamina*, *balanced power* and *smooth operation* the "Cat" No. 12 Motor Grader is rated in a class by itself. Why take less for the big tasks ahead?

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

EXTENDING RUNWAYS . . . a finishing job . . . requires smooth operation, and is a typical chore for the "Cat" No. 12 Motor Grader. This project is at Patterson Field. General contractor: W. L. Johnson Construction Co., Columbus, Ohio.

2,000,000 YARDS of excavation, flood control and irrigation are involved at the Trenton Dam, Nebraska. The power and maneuverability of this "Cat" No. 12 Motor Grader pay off in real production. Contractor: Martin Green Construction Co., Trenton.

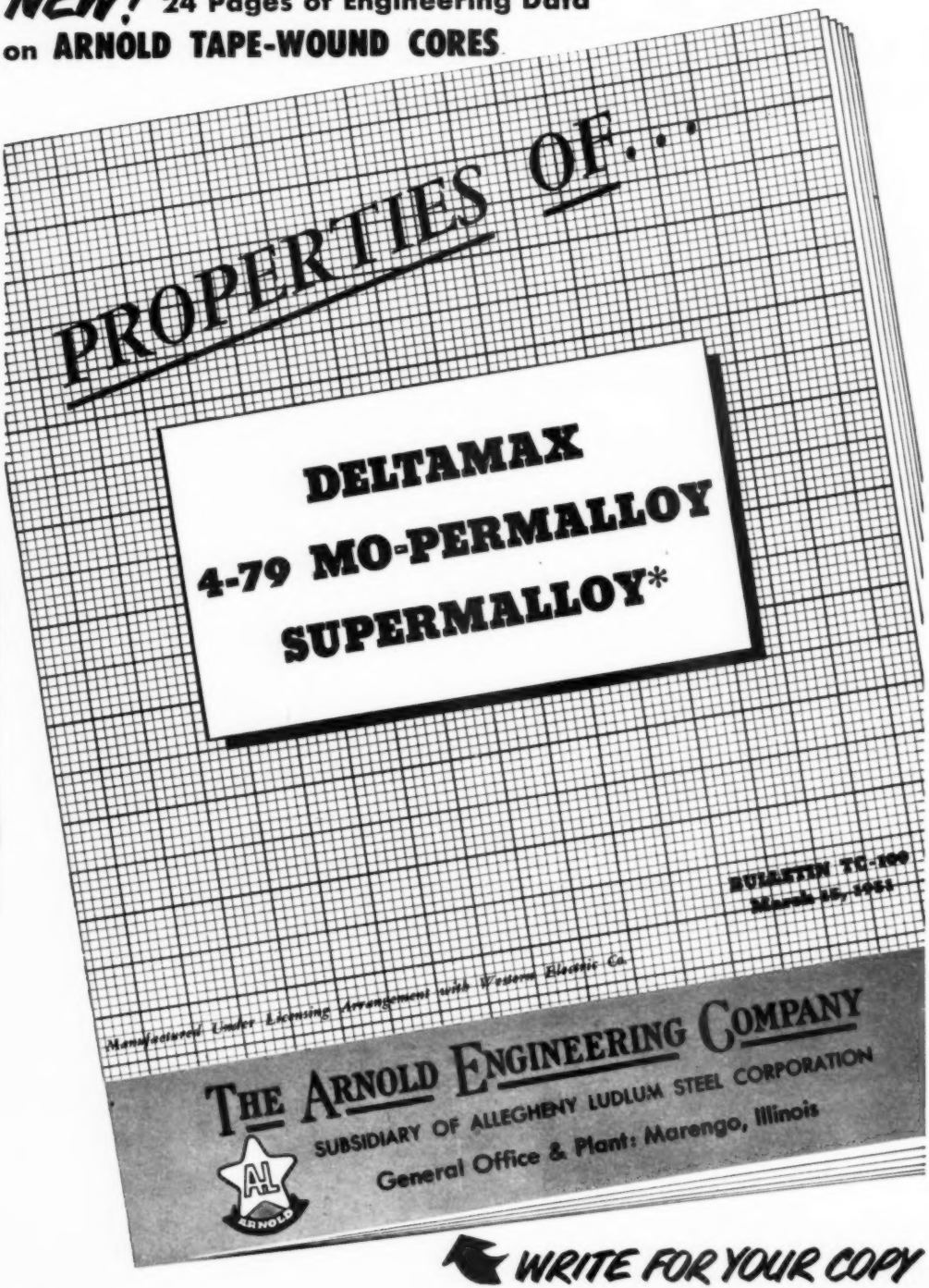
SCRAPERS FOLLOW on the heels of this fast-stepping "Cat" No. 12 Motor Grader. It's grading return road on the Ukiah Project on U.S. Highway 99, north of Calpella, California. "You can't beat a No. 12," says J. H. Beale, superintendent for Guy F. Atkinson Co., San Francisco.

CATERPILLAR

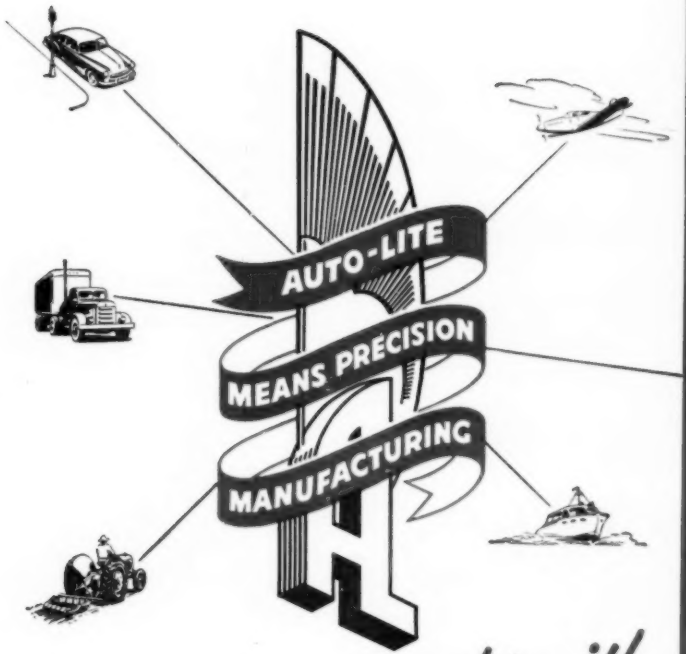
REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

NEW! 24 Pages of Engineering Data
on **ARNOLD TAPE-WOUND CORES**



WRITE FOR YOUR COPY



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AUTO-LITE

AUTO-LITE serves the nation's needs . . . with more than 400 products used as original factory equipment on many leading makes of America's finest cars, trucks and tractors. By building products of the highest quality and dependability . . . Auto-Lite has grown to be the world's largest independent manufacturer of automotive electrical equipment . . . and the best advertised name in the automotive after market. Today's buyers of cars and trucks know "You're Always Right With Auto-Lite."

THE ELECTRIC AUTO-LITE COMPANY
Toledo 1 Ohio

- Spark Plugs
- Fuel Pumps
- Bumpers
- Regulators & Relays
- Generators
- Distributors
- Windshield Wipers (Electric)
- Batteries
- Die Castings
- Plastics & Metals
- Governors
- Coils & Condensers
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- Switches
- Lighting
- Motors
- Wire & Cable
- Instruments & Gauges

WORLD'S LARGEST INDEPENDENT MANUFACTURER OF AUTOMOTIVE ELECTRICAL EQUIPMENT

ACCURACY AND FLEXIBILITY WITH NEW WATTMETER BRIDGE

Another addition to Sperry's complete line of microwave test and measuring equipment, *Microline*, is a new, highly-accurate Wattmeter Bridge. Model 123B is extremely versatile and will not be made obsolete by future requirements in bolometer operating resistance.

► With accuracy to which power dissipated in the bolometer element can be measured to ± 3% of the full scale reading, this meter is capable of operation with either thermistor or barretter. This is possible by the selection of the proper plug-in unit (listed in table at right).

► Model 123B is calibrated in both milliwatts and DBM. Five power ranges are available 0-0.1, 0.3, 1.0, 3.0 and 10.0 milliwatts. Pulse power, as well as c-w power, can be measured with this bridge and appropriate bolometers.

► Write our Special Electronics Department for further details.

Model 123B Wattmeter Bridge is supplied with any one of the following plug-in units:

200B for 200 ohm barretter operation
125B for 125 ohm barretter operation
200T for 200 ohm thermistor operation
135T for 135 ohm thermistor operation
100T for 100 ohm thermistor operation

Visit our booths 57-58-59 at the Radio Engineering Show, March 19-22.

SPERRY GYROSCOPE COMPANY
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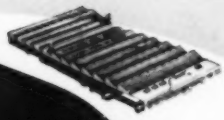
Kelsey-Hayes

Know How

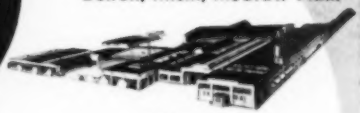
...in DEFENSE and PEACE-TIME production

Kelsey Hayes



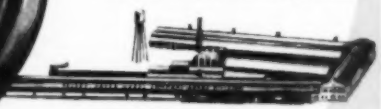
Kelsey-Hayes
Los Angeles, Cal. Plant

Kelsey-Hayes
Detroit, Mich., McGraw Plant



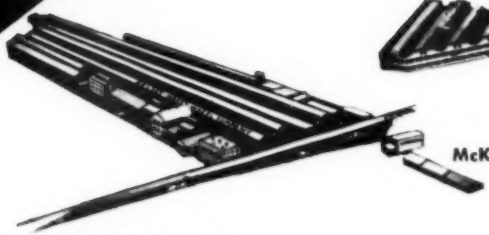
Kelsey-Hayes
Windsor, Ont., Canada Plant

Kelsey-Hayes
Detroit Mich., Military Plant



Kelsey-Hayes
Jackson, Mich. Plant

Kelsey-Hayes
Davenport, Iowa Plant



Kelsey-Hayes
McKeesport, Penna. Plant

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Electric brakes, brake power equipment, power chambers . . . and valves for all types of military and civilian vehicles.

Shells and shell casings, rockets, and aircraft engine parts, etc.

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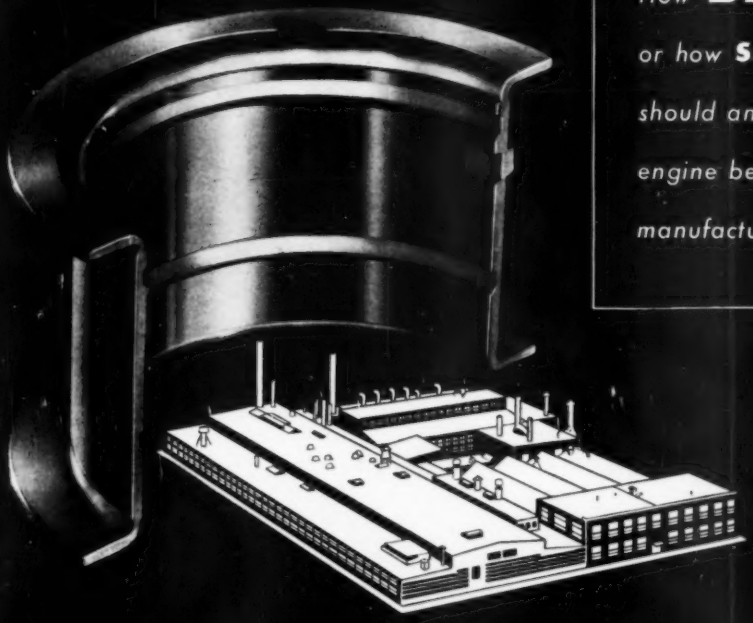

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or how **SMALL...**
should an
engine bearing
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Our *BIGNESS* lies in our capacity to meet huge, mass-production requirements of our customers . . . our *SMALLNESS*—in the flexible use of our facilities to solve their most exacting problems of custom-production.

Because of this combination of abilities, we have been a supplier of original-equipment engine bearings to the leaders in the automotive industry for more than 25 years.

THE DETROIT ALUMINUM & BRASS CORPORATION
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Deep-Drawn Shapes for ORDNANCE

produced by the

Scaife

Reverse-Draw Process

Starting with a circular sheet of steel—

a cup is formed by a conventional drawing operation.

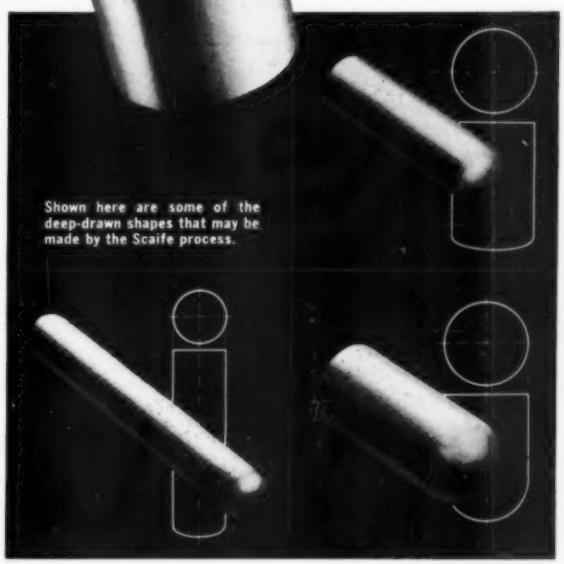
A continuation of this pressing operation turns the cup "inside out" without removing it from the dies—

completing—in a single continuous stroke—the deep-drawn shape.

This modern, proven method of making deep-drawn shapes avoids conditions that produce thin, weak wall sections, or thick, heavy sections. Wall thicknesses produced by the Scaife method are uniform throughout the entire length of the draw.

Various symmetrical shapes can be produced from both ferrous and non-ferrous metals, suitable for rocket and missile bodies, pressure vessels and containers, housings of various types and many other parts or enclosures.

We will be glad to have your inquiries regarding deep-drawn shapes up to 36 inches in diameter and ¼-inch wall thickness.



Shown here are some of the deep-drawn shapes that may be made by the Scaife process.

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A beautiful new Underwood All Electric Typewriter!

Flick the switch and you're ready to go . . . ready to run off the smoothest flow of words you've ever typed . . . and with greater speed, greater accuracy, less fatigue than ever before.

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Also . . . **NEW INTERNAL CUSHIONING** reduces fatigue and nerve strain to a minimum. It's so smooth, so restfully quiet, you can work more efficiently in relaxed comfort.

Yes, this Underwood All Electric *is* the realization of a secretary's dream . . . of everything a typewriter should be.

You'll love the new Electric Margins that set in a flash . . . and the Internal Cushioning that chases typing fatigue. And your boss will love the crisp, uniform work. Every letter . . . better!

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134

UNDERDRIVE PRESSES

simplify material handling

IN FORD'S NEW BUFFALO STAMPING PLANT

In producing big stampings, material handling efficiency is vital. Danly Underdrive Presses like the one shown here help solve the problem in the huge new Ford Motor Company Buffalo Stamping Plant. Underdrive press design provides maximum headroom for crane clearance and permits press servicing and maintenance on a sub-floor level. The actual working area is clear and unobstructed.

Danly Underdrive Presses incorporate all of the exclusive Danly features that assure steady, dependable press operation—the Danly Cool-Running Clutch, pressure lubrication and precision construction. Call a Danly Press Engineer today for detailed discussion of the application of Danly Presses to your stamping operation.

DANLY

IT COSTS LESS
TO RUN A DANLY PRESS

DANLY MACHINE SPECIALTIES, INC.

1000 Ton Danly Underdrive Press shown in operation producing floor panel stampings for Ford automobiles. Bed area of press is 180" by 100". The conveyor feeding the press, part of Ford's "Automation" system for mechanical material handling, is synchronized with the press cycle.

Taking the bite out of weather

Koppers Bituplastic* Protective Coating does not "alligator." This is a major improvement over many types of coatings commonly used to protect exposed metal, concrete and masonry from the ravages of weather.

For when a protective coating "alligators" . . . breaks down into those unsightly cracks like the scale on an alligator's back . . . portions of the underlying surface are frequently exposed, and protective efficiency is lowered.

Koppers Bituplastic guards against that. It's also waterproof, fire-retardant, virtually odorless and tasteless. It withstands extremes of temperature. It's an effective vapor seal over insulation . . . and can be used as a bond between the surface to be insulated and the insulation itself. Koppers Bituplastic completely covers exposed surfaces with a thick, tough, quick-drying coating that provides effective, lasting protection against corrosion and deterioration.

To meet varying corrosive conditions, Koppers makes a complete line of Industrial Protective Coatings. Koppers representatives will gladly recommend the Coatings that will give your plant the best protection—that will hold your maintenance expense to a minimum. Write us, without obligation, for new Protective Coatings Catalog.

*T. M. Reg. U. S. Pat. Off.

Koppers Industrial Coatings are sold through Industrial Distributors

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Rockwell Report

by W. F. ROCKWELL, JR.
President
Rockwell Manufacturing Company

EVERY YEAR, at annual report time, we face the problem of what to include beyond bare financial figures. A business isn't just a name, a balance sheet, or products. Its corporate personality and health are influenced by many things—people, tradition, geography, management philosophy, competitors, "the times," changing markets, and dozens of other factors, often including luck.

A few years ago the Rockwell Manufacturing Company was a pretty small business. Compared to many American corporations, it still is, although its growth has been very rapid. It's our plan, through a series of informal advertisements, of which this is the first, to make the steadily increasing number of customers, employees, stockholders and suppliers better acquainted with the Rockwell Manufacturing Company by putting into the record some of the interesting incidents which shape a Company's personality.

• • •

Once a second, for over 20 years, a battery of our Nordstrom valves has been turned off and on by the action of arms attached to gasometers in the Union Oil Company's plant in Santa Barbara County, Calif. The valves originally installed were a constant source of trouble because they had no lubrication. The Nordstrom lubricated plug valves installed as replacements are still on duty more than 20 years or 600,000,000 operations later.

• • •

Even as the manufacturer, we're often surprised at the ingenious, time-and cost-saving applications customers find for our Delta power tools. Here's a few recently reported from Wisconsin: Racine Pattern Works got tired of wrestling heavy bath-tub castings around for machining, so a Delta 17" drill press was mounted on a slide to move the machine along the fork to drill the flanges. The Wisconsin Motor Corporation mounted eight 14" Delta drill presses in a single set-up to simultaneously drill 8 smoke holes in 3,080 aluminum pistons each 8-hour day. The Heil Company mounted eight 17" Delta drill presses with two-, three- and five-spindle heads to drill 19 holes on five surfaces of a shallow-well pump housing in a single set up. The Delta sales department in Milwaukee has collected hundreds of case histories of successful special set-ups as a guide to production men with a problem of their own.

• • •

Uncle Sam gets all that's coming to him when you slide your money across the bar for a glass of beer. That's due to a 270-pound hunk of bronze machinery, called a beer meter, of which there is at least one in every brewery. Periodically tested by the Bureau of Standards for the Internal Revenue Department, they account for about $800,000,000 a year in taxes. Beer meters are another of our diverse products.

• • •

In acquiring eight companies in the last ten years we've been more interested in buying management than plants and tools. While we have a headquarters staff with specialized abilities in all phases of business operation, it is an advisory staff. The individual plant manager has the authority and responsibility to run his operation as if it was his own business—which in some cases it once was. Actually, therefore, the Rockwell Manufacturing Company is simply a group of small businesses, each locally managed, each a part of its own community, and each successful in itself.

First of a series of informal reports on the operation and growth of the
ROCKWELL MANUFACTURING COMPANY
PITTSBURGH 8, PA.

ATOMIC ENERGY

REACTOR DEVELOPMENT

The Atomic Energy Commission recently announced that negotiations are nearing completion with four groups of business and industrial firms under a previously announced program for expanded participation in reactor-development projects and that no additional groups can be admitted at this time.

The four groups submitted proposals to provide for special studies of the practicability of business and industry to build and operate reactors for the production of fissionable materials and power. They were submitted by the following: (1) the Monsanto Chemical Company, St. Louis, and its associate, the Union Electric Company of Missouri, St. Louis; (2) the Detroit Edison Company of Detroit and the Dow Chemical Company of Midland, Mich.; (3) the Commonwealth Edison Company and the Public Service Company of Northern Illinois, Chicago; (4) the Pacific Gas and Electric Company and the Bechtel Corporation of San Francisco.

Consideration by the Commission of additional proposals will be postponed for the time being since it is felt that four study projects are the maximum that can be carried on simultaneously in view of the demands that will be placed on technical personnel of the AEC and its laboratories and contractors. The two laboratories principally concerned are the Argonne National Laboratory at Chicago and the Oak Ridge National Laboratory at Oak Ridge, Tenn., both of which have heavy development programs of high importance to the national defense.

These study projects do not include a special proposal by the Bendix Aviation Corporation of Detroit for study of a reactor for the production of isotopes to be built with private funds.

All costs will be borne by the companies with the exception of costs to AEC and its contractors incidental to making information and consultation services available. The distribution of the final report submitted on the project will be determined by AEC. All inventions and discoveries made during the work will be the property of the Government.

ATOMIC ENERGY PROGRAM

The atomic-energy enterprise of the United States is big. Its operations extend from the ore fields of the Belgian Congo and the arctic region of Canada to the weapons proving ground at Eniwetok Atoll in the Pacific and the medical projects studying the aftereffects of

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29 Hyster Tractor Tools

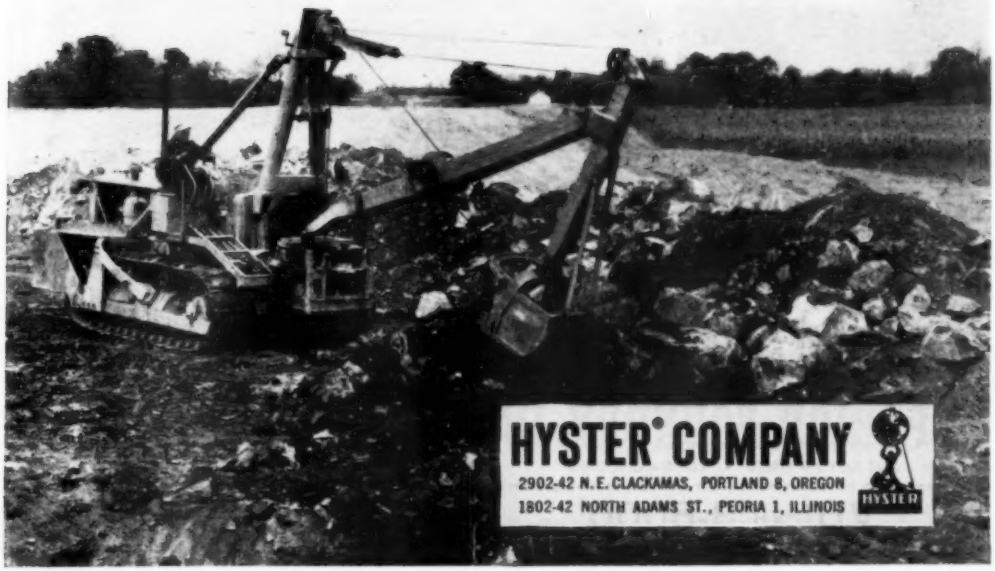
. . . include a complete line of winches, yarders, donkeys, cranes, logging arches and sulkies; Grid Roller for bituminous road salvage; and Hystaway, the 5 in 1 tool that includes dragline, clamshell, crane, shovel and backhoe.

Hyster Tractor Tools make money for their owners in construction, logging, oil fields, road work, and in many branches of general industry.

For 22 years Hyster has made tractor tools for use with Caterpillar track-type tractors. Mounted on the big yellow machines, dependable Hyster tractor tools are at work on the roughest, toughest jobs all over the world.

Hyster tractor tools are sold and serviced by more than 400 Caterpillar-Hyster dealers around the globe.

Hystaway is a military tool with great aggressive mobility. Mounted on a Caterpillar D8, D7 or D6 with bulldozer, Hystaway has full tractor maneuverability, plus the 5-way versatility of dragline, clamshell, crane, shovel and backhoe.



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This Tractor Transmission Case is used in rugged applications and we successfully met exacting requirements as to uniform material structure, close dimensional tolerance and fine finish.

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THESE are just a few of the modern facilities that enable Superior to produce castings ranging from 1/2 lb. to 1200 lb. in any quantity and to your particular specifications. Whether you want straight cupola gray iron or electric furnace iron castings with or without alloys, you'll discover that Superior Foundry's complete metallurgical control assures uniform grain structure, adherence to your specifications and a clean, smooth finish. Bring your production casting problems to us today.

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Atomic Energy

atomic bombing in Hiroshima and Nagasaki in Japan. They include major research centers at Brookhaven and Schenectady in New York State, Chicago in Illinois, Ames in Iowa, Los Alamos in New Mexico, Oak Ridge in Tennessee, and Berkeley in California. They include the 400,000-acre reactor-testing station in Idaho and the huge production facilities at Hanford in the State of Washington and at Oak Ridge.

In Ohio they include Miamisburg Laboratory near Dayton, the uranium processing operation of the Harshaw Chemical Company in Cleveland, the beryllium plant at Luckey, near Toledo, nineteen research projects at universities and private laboratories, and a number of smaller industrial contractors.

There are more than 80,000 people employed in this program, of whom only about 5,200 are employed directly by the AEC. The rest work for the industrial and research contractors who perform virtually all the operations carried on under the guidance of the AEC.

The total land area occupied by the facilities described amounts to some 2,800 square miles—an area almost equal to the States of Rhode Island and Delaware combined. The capital investment—that is the money expended for plant and equipment alone—will amount to something like $2.5 billion by the end of this fiscal year—a fact which places the AEC very near the top of the list in capital investment among the great industrial enterprises of this country. As a matter of fact, it is in third place—only A. T. & T. and U. S. Steel being larger.

Not only is the atomic-energy enterprise big, it is getting bigger—and at a very fast rate. We are now in the midst of a program of tremendous expansion of our production facilities which will eventually cost nearly $2 billion. When this expansion is completed, our capital investment will total $4.5 billion. Under this program new construction is being carried on at practically every existing installation, and in addition such new facilities are being started as a $900 million production plant in South Carolina, a $500 million plant in Kentucky, and a number of lesser plants in various other parts of the country, including a uranium-processing plant near Cincinnati, Ohio.

To give a clearer picture of just what this atomic-energy enterprise is all about, I would like to sketch very briefly the main fields of endeavor of the AEC.

1. We have a program for the acquisition of uranium ore. We don't mine this ore ourselves: we buy it, and we buy it wherever it is for sale to us, both at home and abroad. *(Continued on p. 62)*

GET THESE BASIC HELPS ON ALUMINUM

Alcoa booklets and films can save you countless hours in specifying, designing and training your men. They are a condensation of Alcoa's 63 years of aluminum knowledge.

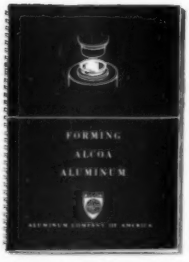
The key to Alcoa's technical library is a folder which lists and explains all booklets and films. Ask your local Alcoa sales office for a copy. Or write: ALUMINUM COMPANY OF AMERICA, 850G Gulf Building, Pittsburgh 19, Penna.

ALCOA ALUMINUM AND ITS ALLOYS. Fundamental information, with tabular data on chemical and physical properties, tolerances. 168 pp. 55 tables.

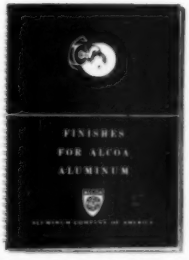
WELDING AND BRAZING ALCOA ALUMINUM. Manual: methods, equipment; including tungsten-arc welding. 130 pp. 52 illus. 18 tables.

RIVETING ALCOA ALUMINUM. Detailed information on riveting aluminum and its alloys. Covers joint strength, alloys, methods. 56 pp. 19 illus.

MACHINING ALCOA ALUMINUM AND ITS ALLOYS. Discusses best tools, methods, and equipment; cutting speeds and feeds. 68 pp. 6 tables. 21 illus.



FORMING ALCOA ALUMINUM. Explains various methods and discusses forming characteristics of aluminum alloys. 64 pages. 11 tables. 21 illus.



FINISHES FOR ALCOA ALUMINUM. Mechanical, chemical, electro-chemical, electroplated, and organic finishing methods. 59 pp. 40 illus.

ALCOA ALUMINUM IN AUTOMATIC SCREW MACHINES. Tool design, set-up, chip control, deep-hole drilling, other machining. 95 pp.

ALCOA

First in Aluminum

when it's

Rough Outside

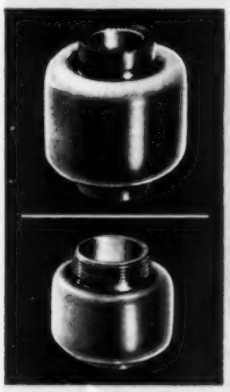
in the Worst Terrain

O & S BEARINGS

NON-METALLIC • SELF LUBRICATING

help keep it

Smooth Inside



FOR FIRE ACCURACY AND CREW COMFORT

Tanks are one of the most important elements of warfare. They must be constructed to operate efficiently, with a minimum of maintenance, under the worst possible battle conditions. Every piece of equipment that goes into a tank must undergo rigid tests.

The failure of an O & S bearing could render a shock absorber useless and thereby impair the smooth action of the tank. Thus the efficiency of the operator and the accuracy of the tank armament could be greatly reduced.

O & S bearings are rigidly and efficiently constructed to qualify for use in this very important installation.

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Atomic Energy

2. We have a program for processing this uranium ore to degrees of extreme purity. This is a fairly straightforward process, and it is done by a number of different industrial contractors to the AEC located in various parts of the country.

3. We have a program for the production from this purified uranium metal of the fissionable materials plutonium and uranium-235. These materials are produced in the great Commission-owned but privately operated production centers at Hanford and Oak Ridge by processes that are unique in industry, and it is our capacity to produce these materials that will be greatly increased when the new plants in South Carolina and Kentucky go into operation.

4. We have a program for the utilization of these fissionable materials in the production of atomic weapons.

5. We have a program for the development of nuclear reactors designed to utilize fissionable materials in the production of power for useful purposes.

6. We have a program for the production and distribution of radioisotopes produced in the Commission's nuclear reactors.

7. We have a program of research designed to add to our basic knowledge of nuclear forces, to make our production processes more efficient, to protect the health and safety of our workers and the population in general, and to discover an increasingly wider variety of peaceful uses for the atom.—T. KEITH GLENNAN, *U.S. Atomic Energy Commission, at Case Institute of Technology, Cleveland, Ohio.*

NUCLEAR ENGINEERING

Representatives of twenty-two United States industrial firms will acquire specialized training in nuclear engineering at the Oak Ridge School of Reactor Technology during the 1951-1952 term beginning in September.

Of a total of 75 students who will attend the 12-month term, 24 candidates are sponsored by the industrial firms and 8 by Government agencies. The remaining 43 are recent college graduates selected primarily on the basis of their potential contribution to reactor-development phases of the national atomic-energy program.

The School of Reactor Technology was established in March 1950 at the Oak Ridge National Laboratory to train engineers and scientists. The industrial and governmental trainees will be paid by their employers during the training period. Recent college graduates will be considered student employees during the training. At the end of the year this group may become available for employment by the Atomic Energy Commission, its contractors, or other organizations interested in reactor development.

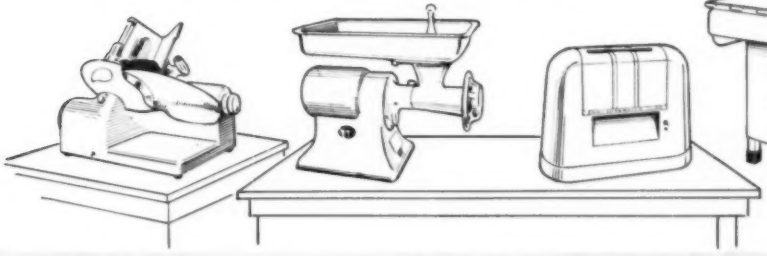
Look at Quantity Feeding *this* way!

Why tolerate production methods in a mess-kitchen or galley that wouldn't be allowed for an instant in an efficient plant? Why put up with the high cost and low output of wasteful hand methods—or of inefficient food machinery?

Look at it this way: your finished product is a healthy, balanced meal, quickly served in pleasant surroundings—an increasingly important industrial and military asset. Your raw materials consist of meat, eggs, vegetables, cereals, beverages—in quantity. Efficient production calls for flow and methods based on dependable, high-output, trouble-free food and kitchen machines. Literally, without such machines as *built by Hobart*, quantity feeding today would be economically impractical.

Whether you're operating a quantity feeding operation today, installing one, or modernizing one, let us suggest that you do this: consider your meal production just as you would factory production. Then ask for recommendations from your convenient local Hobart representation. As the world's largest manufacturer of food, bakery and kitchen machines, Hobart can meet your requirements with the widest range of capacities in the greatest line of machines—can help you consolidate planning, purchasing and servicing.

You see Hobart food machines —almost literally—*wherever food is prepared, served or sold.* Your convenient Hobart representation can quickly show you why.



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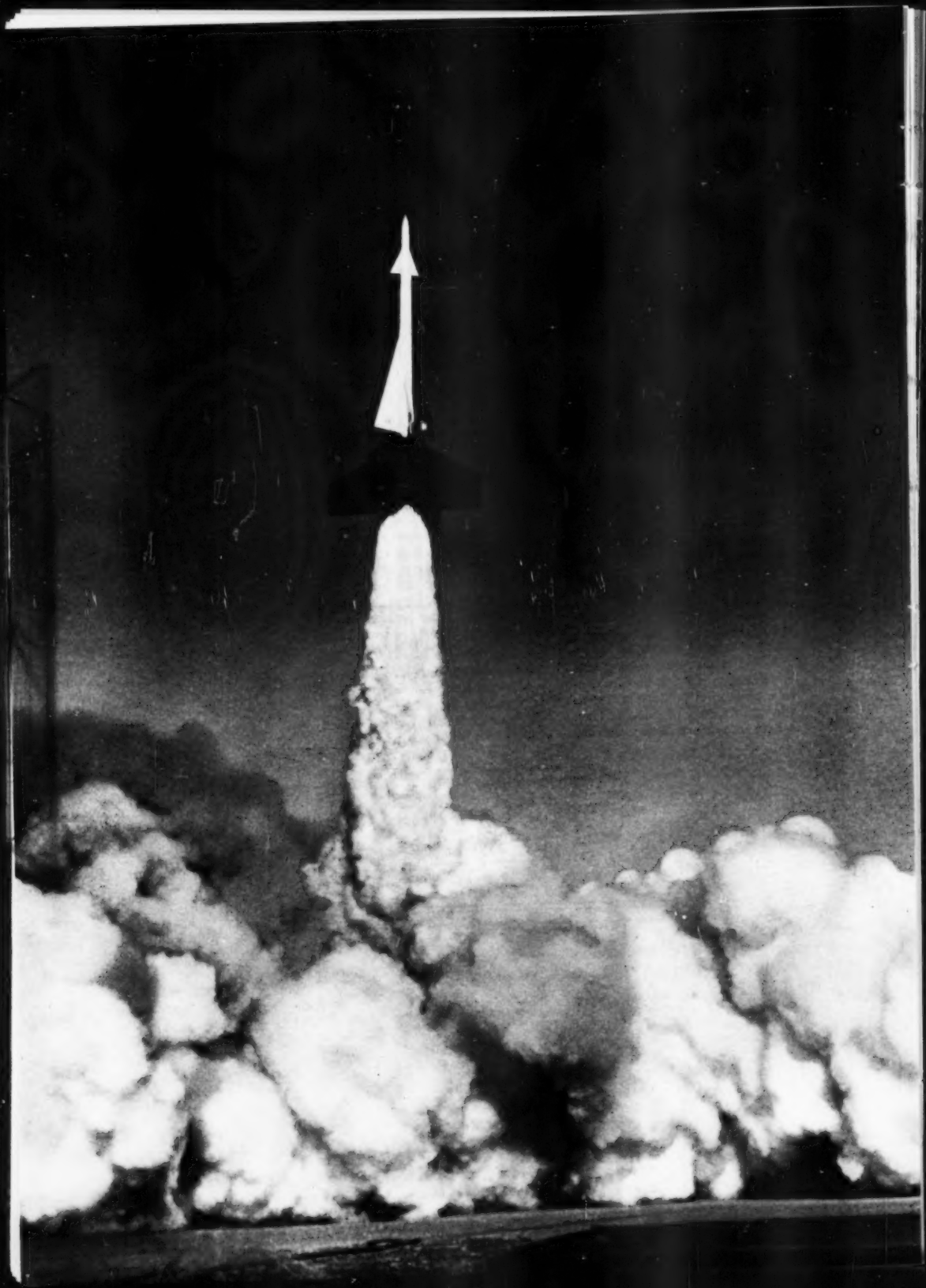


The Air Matériel Command

Important Nerve Center of Vital Air Force Developments

DURING World War II the Air Matériel Command, located at Wright-Patterson Air Force Base, Dayton, Ohio, in conjunction with American industry delivered to the American Air Force a total of 248,000 aircraft. To keep these aircraft flying it was necessary to procure 60,000 different kinds of spare parts and equipment—an accomplishment far more complex than that of the largest industrial enterprise anywhere.

The Air Matériel Command helped to direct the wartime expansion of the aircraft industry, supervising production, selecting manufacturers, abolishing bottlenecks, and inspecting finished products.

Inspection alone constituted a major undertaking. A heavy bomber, for example, has more than 400,000 component parts. The manufacture of a single radial-type, air-cooled engine involves more than 30,000 major and minor inspection operations.

18 Million Tons

From Pearl Harbor to V-J Day, Air Matériel Command supply depots received and shipped 18 million tons of supplies—enough to fill 353,000 railroad freight cars. An average of five tons of supplies was shipped each month for every aircraft overseas. So well distributed were these supplies that only 2 out of 1,000 combat B-29's were grounded at the end of July 1945 for lack of parts.

In addition to procurement, inspection, and supply functions, the Air Matériel Command must keep a very high percentage of our aircraft in operation at all times.

By the use of production-line maintenance techniques and know-how borrowed from American industry, 275,000 aircraft engines were completely overhauled by this Command between Pearl Harbor and V-J Day.

Aircraft instruments were also repaired. In one month, just prior to V-J Day, more than 90,000 instruments, some of them more complex than a fine watch, were reconditioned.

At the peak of wartime operations, the Air Matériel Command employed more than 500,000 military and civilian personnel in the continental United States. To carry out its functions and responsibilities in combat theaters, the Command in one year alone trained over 50,000 officers and enlisted men.

Today, in addition to its gigantic routine responsibilities, the Air Matériel Command is accelerating a vast engineering and research program.

Atomic Propulsion

In collaboration with the U. S. Atomic Energy Commission and private industry, all possible applications of nuclear energy to the propulsion of aircraft are being explored. This program includes the study of closed-cycle turbines, open-cycle turbines, turbojets, turbo-propellers, ram jets, rockets, and compound engines.

As a result of the advances in powerplant development, additional problems have arisen because of the extreme accelerations encountered in supersonic aircraft. Whereas conventional engines have been called upon to operate at a maximum rate of climb approximating 5,000 feet a minute, pilotless aircraft are now envisaged which will climb in excess of 100,000 feet a minute.

The Air Matériel Command, under Lieut. Gen. Benjamin W. Chidlaw's efficient leadership, extends a cordial welcome to Association members to rendezvous at Wright-Patterson Air Force Base in connection with their Annual Meeting in the fall. Announcement of the Annual Meeting is on page 95 of this issue.

Lieut. Gen. Benjamin Wiley Chidlaw, Commanding General of the Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, has had nearly thirty years of aviation experience as instructor, engineer, and commander of American and Allied tactical air forces. He is rated a command pilot and combat observer with nearly 6,000 flying hours, including numerous combat missions over Europe in World War II. General Chidlaw's photograph appears on the front cover of this issue.

He was born in Cleves, Ohio, in 1900. In 1922 he was graduated from the U. S. Military Academy and appointed a second lieutenant of Air Service. During his flight training he specialized in pursuit aviation and later was an instructor at both Brooks and Kelly fields. He first became acquainted with Wright-Patterson Air Force Base as a student in the Engineer School and subsequently as project officer for aircraft design, development, and testing.

In 1939 General Chidlaw began service as chief of the Experimental Engineering Branch of the Matériel Division of the Air Corps. During this period he monitored and directed the development of the original jet engine and jet airplane.

During World War II he commanded the 22nd Tactical Air Command and, later, the Mediterranean Allied Tactical Air Forces. Upon the conclusion of hostilities he returned to Wright-Patterson Air Force Base and devoted himself to specialized research and engineering duties. He became Commanding General of Air Matériel Command in 1949.

INTO THE BLUE *at supersonic speed roars one of the Nation's newest Army Ordnance antiaircraft missiles guided by a complex system of radar and electronic controls.*

PLANNING FOR WAR

Defense photo

by

Maj. Gen. J. F. C. Fuller

"What is the Western problem? It is first to prevent Russia gaining Lenin's primary objective by military force, and secondly it is to exploit the moral weakness of the U.S.S.R."

EVERY plan of war demands that the government first define its political aim and, secondly, that its strategists determine on the means to attain it. To be rational, the aim must be related to the more probable causes of war, and to be effective the means must be sufficient in wartime to create a situation in which the aim is realizable. Therefore the aim must also be related to the means, for it must not be beyond their powers to achieve.

Complex Problem

Taken as a whole, these truisms constitute an exceedingly complex problem, embracing a host of factors—political, geographical, industrial, financial, strategical, logistical, tactical, social, moral, etc.—in fact, all the war potentials of the probable belligerents.

When their values are assessed, it will be found that some are more important than others. Of the more important, the strategists must decide which one is so vitally important to the potential enemy that, should he be deprived of it, he is likely to lose the war. This factor I will call "the strategical center of gravity of the war," and because it should constitute the hub of every war plan, in this study I intend to make it my main theme.

As far as I am aware, Clausewitz was the first student of war to broach this subject. Considering a war against a coalition, what he said was this:

Should one of the states forming it be in "interests and forces" so superior to the others that for their success in the field they depend upon it, "the easier it is to look upon the different enemies as one alone, and the more readily we can simplify our principal enterprise to one great blow; and as long as this is in any way possible, it is the most thorough and complete means of success." Then he went on to say:

"Center of Gravity"

"We may, therefore, establish it as a principle that we can conquer all our enemies by conquering one of them. The defeat of that one must be the aim of the war, because in that one we hit the common center of gravity of the whole war."

Clausewitz was thinking mainly in terms of military forces, because in his day the potentials of war were few and simple. But as they no longer are, all must be included in his idea, and

in my attempt to do so I must ask for the indulgence of the reader and beg him not to be overcritical should he not agree with my deductions.

"Like a Wheel"

After all, the point of real importance is not whether they are right or wrong but that, like a wheel, every war plan should be built round its hub—the strategical center of gravity of the war. In order to make this clear, first I intend briefly to examine World War II and next the political and strategical situation as it now faces us.

Although history shows that the causes of war are multifarious, in our industrial civilization two are dominant—the economic and the ideological. Thus, as regards the first, in September 1919 President Woodrow Wilson said of World War I: "My fellow citizens, is there any man here, or any woman—let me say, is there any child here—who does not know that the seed of war in the modern age is industrial and commercial rivalry? . . . This war, in its inception, was a commercial and industrial war. It was not a political war."

The same may be said of World War II. It was not Hitler's political doctrines which precipitated it; it was the success of his new economic order, based on barter and subsidized trading, because it enabled him to avoid or jump his competitors' tariff walls, undercut their trade, and swell the ranks of their unemployed.*

Germany Landlocked

Hitler does not seem to have realized that out of several potential causes of war his attack on the financial and commercial prosperity of his competitors would become the dominant one. What he saw was that Germany, a landlocked country, could never feel secure until she gained command of the land.

Further, in order to neutralize a second blockade—the crucial factor which lost Germany World War I—he considered it essential to extend her *Lebensraum*.

This is clearly stated in "Mein Kampf," in which he wrote: "We National Socialists have purposely drawn a line through the line of conduct followed by prewar Germany in foreign policy. We put an end to the perpetual Germanic march toward the south and west of Europe and turn our eyes toward the lands of the East. . . . But when we speak of new territory in Europe today we must principally think of Russia and the border states subject to her."

When war came, this aim was complicated by the fact that, seemingly contrary to Hitler's expectations, his invasion of Poland at once brought England and France into the war against him. This meant that, were he next to invade Russia, he would be faced by war on two fronts. To avoid this, he decided to annihilate his Western enemies first.

To all intents and purposes this was a preventive operation, a war to prevent Germany from being attacked in rear once her front became engaged in Russia. Where did its strategical center of gravity lie? In the English Channel, for unless England were invaded and subdued, the Western Front would remain in being.

But Hitler was in no way prepared to invade England, nor could the means be rapidly improvised. Thus it came about that, after his abortive air attack on England, he abandoned his line of operations.

According to Napoleon, to change one's line of operations is an act of genius, but a general who loses (let alone abandons) it deserves to be shot. This, as eventually happened, was Hitler's fate.

General Fuller, noted British soldier-author, is one of the outstanding military analysts and historians of the present day. As an officer in World War I he was one of the foremost advocates of tank warfare and did much to mount the armored attacks that proved the value of the bulletproof track-laying vehicle. He is a Companion of the Bath, a Commander of the Order of the British Empire, and a Companion of the Distinguished Service Order.

The Barbarossa Plan

Meanwhile, his aim to seek his *Lebensraum* in Eastern Europe had been elaborated into the Barbarossa Plan. What was its center of gravity?

The answer is a complex one, for Hitler could not possibly hope by force of arms to conquer the whole of the U.S.S.R. Knowing, however, that it was a composite empire, which included many nationalities violently opposed to the Bolshevik régime, of which the Ukranians numbered forty-two millions, by championing their cause and offering them liberation and self-determination the probability is that with their coöperation he would have blown up Russia internally.

His aim, however, was not their liberation but their conquest; therefore the center of gravity of his plan had to be shifted from the psychological to the strategical field. It was to occupy Moscow—not because of its political value but because it was the hub of the Russian railways which, once wrested from Russia, would have wrecked her logistically.

Soldiers Deserted

When Hitler set out to gain Moscow in June 1941, hundreds of thousands of Russian soldiers, mostly recruited from non-Russian nationalities, deserted to his armies, which in Byelorussia and the Ukraine were welcomed as liberators by the civil populations.

But such was the brutality meted out to them that they were rapidly disillusioned, and their cessation to desert and aid their enemy was a factor even more important in saving Moscow then the severity of the winter.

In 1942, having failed to take Voronezh, Hitler once again abandoned his line of operations to seek his goal in the Caucasian oil fields. This was a blunder as fatal in its consequences as his first. From the rail hub of Moscow the Russian armies in the Volga region were reënforced, and Hitler's dividend was Stalingrad.

Though Hitler bungled his war,

*The New Economic Order and the New Deal were initiated in 1933. By 1936 the first had reduced German unemployment from six to one million; yet the second, after eight years' trial, still left eleven million unemployed in the U. S.

England and France, and later on America also, did no better. On entering the war they proclaimed their aim to be an ideological one—the extermination of Hitlerism. Where did its center of gravity lie? In the hearts of the German people, for could they be persuaded to revolt and overthrow the Hitler régime, Hitlerism would be destroyed by the people themselves, as Kaiserism had been in 1918.

This was totally overlooked, and whereas in World War I President Wilson's "Fourteen Points" drove a psychological wedge between the leaders of his enemies and their peoples and by sundering them shortened the war, in World War II, President Roosevelt's "Unconditional Surrender" delayed the collapse of Italy and rendered German resistance fanatical.

Not only did this psychological blunder lengthen the war, but it directly led to the establishment of Russian autocracy over nearly the whole of Eastern Europe and much of Central Europe as well.

From the very start it was so little appreciated that the center of gravity in an ideological war is psychological, that strategic bombing was as completely misapplied as was propaganda. Instead of it being directed against the German centers of transportation which would have caused an ever-increasing paralyzation of civil and military traffic, and therefore would have demoralized the people and disorganized the fighting forces, its main aim was to destroy German civil morale!

Inept Practice

Nothing could have been more inept because, as history has shown time and again, a loyal people cannot rapidly be terrorized into submission, and even should sections be disloyal—as was the case in Germany—to deprive them of their homes and subsistence is more likely to compel them to depend on their government for the means of survival—and therefore to accept its authority—than to stimulate their treachery.

Though in the end Germany was defeated by sheer bludgeoning, the fact remains that, because Stalinism replaced Hitlerism, the Anglo-American political aim was never achieved.

Intercontinental War

Because of this, the present strategical situation is incomparably worse than it was in 1938. Then the causes of war lay within Western civilization, and war was still international. Now they lie between what remains of that civilization and Asiaticism; hence war has become intercontinental.

Thus, once again, Europe is faced by her basic strategical problem, which ever since the days of Xerxes and Darius has been the defense of her eastern border lands against Asiatic aggression.

Until the outbreak of World War I the two great bastions against Asia were the Austro-Hungarian and German Empires. The first disappeared in 1919 and the second in 1945, since when the Slavs have returned to where they were in the days of Charlemagne. Further, the demilitarization of Japan has relieved Russia of all anxiety of a 2-front war.

What Is Russia's Aim?

Coupled with the demobilization of the Western wartime armies and the retention of the bulk of the Russian Army on a war footing, these surrenders to Slavdom have placed the strategical initiative in the hands of the Kremlin. Therefore the first question is: What is Russia's political aim?

It was laid down by Lenin over thirty years ago and has been unswervingly followed by Stalin ever since. It is "to bring to triumph the World Revolution, to create the Soviet Republic of the World." In other words—world revolution spells Russian expansion.

In this vast plan of conquest, Lenin's primary objective was "to unite the proletariat of industrial Germany, Austria, and Czechoslovakia with the proletariat of Russia and thereby create a mighty agrarian and industrial combination from Vladivostok to the Rhine." Strategically, therefore, Central Europe was the center of gravity of Lenin's plan, which, once it was sovietized, would unbar the road to world conquest.

"The technical equipment of the Russian fighting forces will be at its best on the outbreak of war and will deteriorate as the war proceeds. This has always been the cancer of Russian military power."

Moral Disintegration

What were the strategical means proposed to effect this? Like all ingredients of Soviet policy, they also derive from Lenin. "The soundest strategy in war," he said, "is to postpone operations until the moral disintegration of the enemy renders the delivery of the mortal blow possible and easy."

Therefore, in his system of warfare, psychological took precedence over military attack and defense; but, be it noted, not over military power because that is as essential to psychological as to physical warfare.

Today Russia's military power is immense, totaling 2,800,000 armed men—a force which can be doubled on mobilization. This gigantic fighting mass has two purposes. The first is to cover Russia's psychological war by a terror barrage—a standing threat to all who oppose it. The second is to defend herself should her psychological offensive lead to actual war.

Seeing that the Western powers cannot numerically rival her military manpower under any conceivable circumstances, why should Russia have to defend herself should her policy lead to war? There are two reasons: the one is that, in the event of a move westward, her soldiers would enter a contagious area and risk becoming infected by Western culture; the second and more important is that her most feared enemy is within and not without.

What happened in World War I? Russia was not defeated by Germany but by internal revolution fomented by Lenin who offered liberation from Tsarist rule to all non-Russian nationalities within the Russian Empire and,

when liberation was gained, next offered their self-determination.

But once they had overthrown the Tsarist régime, Trotsky having by then created a reliable Russian army, Lenin by force of arms resubjugated the non-Russian peoples.

Revolution Began

As I have mentioned, much the same occurred in World War II. No sooner was Russia invaded by the Germans than revolution against Bolshevik autocracy began to show its head, and had Hitler been as astute as Lenin the probability is that the counterrevolution would have spread and would have led to the overthrow of the Bolshevik régime as in 1917 it had of the Tsarist.

The truth is that the U.S.S.R. is a giant with feet of clay, and it is for this reason and not because of the atomic bomb that the Kremlin is loath to risk an aggressive physical war.

What, then, is the Western problem? It is first to prevent Russia gaining Lenin's primary objective by military force, and secondly it is to exploit the internal moral weakness of the U.S.S.R. The center of gravity of the one lies in Western Germany, and of the other in the hearts of the subjugated non-Russian peoples, within and without the Soviet Union.

The solution of the first is a straightforward task. It is to establish forces of such strength in Western Germany as to make a successful Russian westerly advance highly speculative; for, on account of Russia's internal instability, the Kremlin dare not risk an initial defeat.

Western Army Needed

Though the strengthening of the present forces of occupation has been decided upon, sufficiency will never be attained, physically or morally, until a powerful Western German army has been created. Even then, unless the first task is grounded on the solution of the second problem, all that can be expected is the eventual outbreak of war; for it is in the nature of arms races to lead to war.

Besides securing Western Germany, it is high time the Western powers appreciated that, strategically, the weakest factors in the U.S.S.R. are the vast expanse of its territories and the paucity of its railways.

"The Western powers must recognize that it is the unbearable Bolshevik rule which offers them their means of disrupting Russia psychologically and that this factor cannot be exploited if they fail to appreciate that they must first win the full-hearted coöperation of the subjugated peoples."

Size also renders the air defense of the U.S.S.R. an all but insuperable problem, and one whose difficulties are accentuated by the ever-increasing dispersion of Russian industries. Lastly, the most important railroads linking the Pacific coast with Poland and Rumania traverse the Baltic States, Byelorussia, and the Ukraine, all of which are subjugated countries.

These facts point to one general conclusion: that the technical equipment of the Russian fighting forces will be at its best on the outbreak of war and will deteriorate rapidly as the war proceeds. This has always been the cancer of Russian military power.

The solution of the second problem depends on an accurate assessment of Russia's internal weaknesses. Their basic factor is that the inhabitants of the U.S.S.R. are some sixty per cent Russian and forty per cent non-Russian and that the majority of the latter are opposed to the Bolshevik régime.

Of these many peoples, twenty-four nationalities—thirteen within the U.S.S.R. and eleven without—are represented by an association known as the A.B.N. (Anti-Bolshevik Block of Nations), and as it includes the Ukraine, Azerbaijan, and Turkestan, it covers well over fifty per cent of the coal, iron, oil, and agricultural resources of the Soviet Union. Over forty per cent of Russian soldiers are recruited from the subjugated peoples.

The aim of the A.B.N. is to win freedom for its members. It is opposed to all forms of Russian imperialism, whether Tsarist, Bolshevik, socialist, or democratic. Its goal is the breaking down of the U.S.S.R. and the reconstitution of all subjugated peoples as independent nations. Therefore its members will not fight for any kind of federated Russia.

The Solution

Such are the facts that constitute the second problem. Therefore it is on them that the Western powers must base the solution.

In it they must recognize that it is the unbearable Bolshevik rule which offers them their means of disrupting Russia psychologically and that this factor cannot be exploited if they fail to appreciate that they must first win the full-hearted coöperation of the subjugated peoples. It is not the atomic bomb but the idea of freedom which can triumph over Bolshevism.

Therefore, if the Western powers would win the sympathy of the subjugated nations, they must inspire them. And to do so they must openly recognize their independence and right of self-determination when the ideological weapons, now being used by Russia against all non-Communist countries, will be turned against her by her own non-Russian peoples.

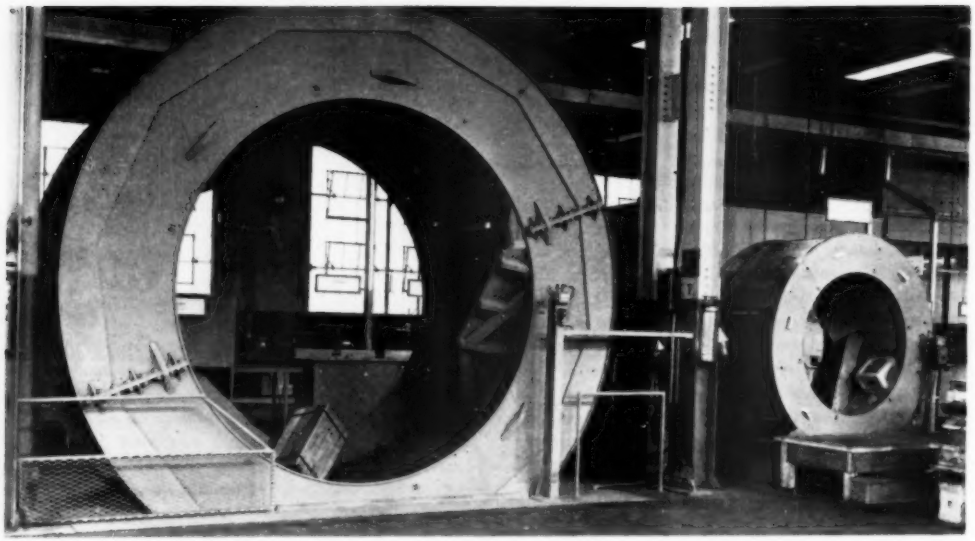
Resistance Movements

Well may it be asked, why should the Western peoples—the self-declared champions of freedom—neglect to use the underground resistance movements within the ideological frontiers of Russia as a means of disrupting her internally when Cominform agents, inspired by the Kremlin, are unceasingly engaged in establishing fifth columns in all their own countries?

The aim of the final plan must be the destruction of Russian imperialism by splitting the U.S.S.R. up into its constituent parts and establishing independent self-governing national states.

For the peace of the world it is far better that the Russian Empire be dismembered, as was that of the Turks, and divided into a score of independent nations, even should they war locally with each other, than to have one Russian leviathan persistently bent upon subverting the world in order to keep less than ten million Bolshevik bureaucrats in power.

New Machinery for the Armed Forces



The revolving hexagonal drums, above, test equipment, shipping containers, and packaging methods at the Engineer Research and Development Laboratories, Fort Belvoir, Va. Below, Navy Seabees, who are once again at work on advance-base and emergency construction overseas, get that "mechanized look" and add luster to the Seabees' reputation for high-speed construction with new time-saving equipment such as this tracked and power-driven trench digger which supplants the old man-powered spade.

Industrial Standardization

A Requisite for Survival in Time of National Emergency

Senator Ralph E. Flanders

THROUGHOUT World War II we had a higher degree of industrial standardization than any nation in the world. American mass production, made possible by the workable interchangeability of parts, was our Number One weapon in that war. Yet we cannot possibly estimate the loss we suffered in men and money, in time and resources, because of the lack of certain proper standards.

Our losses really began in the spring of 1940 when 400,000 Belgian troops might have fought better and longer if British ammunition had fitted their empty rifles.

At home we lost the services of thousands of small companies which would have participated in war production if there had been a comprehensive system of national-defense standards to which they were accustomed to work.

Standardization is economically and socially desirable at any time, but in time of war or preparation for war it becomes nothing less than a requisite for survival.

How do we stand today? Both press and President have stressed the fact that we are in some ways, notably in industrial productive capacity, far ahead of where we were at the start of the last war. As far as standardization is concerned, that is remarkably true.

Stock Numbers Surveyed

In 1945 the Navy—which had spent 55 billions during the war for the goods of industry—called in Remington Rand to help it survey its 50 million stock numbers. Of the first 15 million checked, only 2 million represented parts actually in use. Because some identical parts were listed under as many as 630 numbers, this 2 million in turn was reduced to 80,825. Today the project of simplifying and standardizing the stores of the entire military establishment is well under way.

A major effort is under way to resolve the differences between Government practice and that of private industry in the making of engineering drawings. Requirements in radio and radar equipment are being standardized so that the military can obtain uniform and interchangeable products from many suppliers.

Control of Standards

Standards do not come about by accident. They are born in a conscious effort; they are developed with organized machinery. Today the question of *who* is to control this machinery is a problem of our internal economy that is at once unrecognized, obscure, and crucial.

At the beginning of the industrial age our standards were written by only two men—the maker and the user. Early in the present century, however, the situation became involved with the growing complexities of our industrial society. The Federal Government joined producer and user as the third partner in the making of standards.

This intervention of Government began as a means of curbing abuses in capitalism's iron age, of regulating standards affecting public life, health, and safety. Large Government purchases in and between wars, all of them carrying specifications, next made Federal agencies a directly interested party in many business and industrial fields. Centralized Government buying according to purchase specifications began to cut deeper and deeper as a standardizing influence on industry. A half dozen Federal standardizing agencies were created.

Government obviously has the right to set standards for the goods it buys; that much is granted. Yet there are trends, plans, and proposals currently under way that would make standardization wholly or mainly a function of Government, and I am opposed to them.

Far-Reaching Effects

If you control an industry's standards, you control that industry—lock, stock, and ledger. On the day that standards become a governmental function and responsibility, as is now being threatened, the Government will take a very long step toward the control of American industry. That is a step which will reach into every manufacturing and operating company, big and little, and consequently will affect every consumer in the country.

In such a setup, Government personnel will decide when and what standards should be developed and what the provisions of the standards should be. That method is inflexible. It leaves little room for the manufacturer to experiment with products which do not comply with a standard. It does not allow for improvements in standards and their consequent revision. It does not permit the single manufacturer to depart from a standard in order to develop a specialized and useful business.

Standards made under such conditions tend to become limitations, con-

Senator Flanders of Vermont is well known throughout American industry for his contribution to the advancement of machine-tool practices. He has been a leader for many years in the progress of ordnance design and manufacture. He is especially well equipped to discuss standardization. He presented a similar analysis of this same subject in the January 1951 issue of the *Atlantic Monthly*.

trols, and restrictive procedures. They reduce consumer choice. The manufacturer obeys an order he had no part in formulating. Whether he thinks those orders are good or bad, right or wrong, he follows them, or he resorts to political pressures to get the standards he wants.

Knowledge Lacking

I am opposed to Government control of standards activities, however, for a much simpler reason. No Government planner knows enough to write the standards for the rest of American industry and all other American people. Even if he and his advisers were as wise as Jupiter, he would still stand helpless before economic forces which are too powerful, delicate, and complex for individual control.

Now the situation certainly alters when people begin to shoot at us. In time of war we must quickly take special measures to save materials and manpower, to bring maximum efforts and resources to bear on production and mobilization. Under such pressure there are naturally tendencies and a will to give full authority to a planner or a group of planners, to hand down standards by decree.

A point to remember, however, is that they must still be effective, workable standards. The planner, of course, is no wiser simply because bullets are flying or because he has put on a uniform. The standards, the thousands upon thousands of purchase specifications they hand down, are as likely as before to be unrealistic, uncreative, and unnecessarily expensive. With this added difference—their errors can now be a thousand times more serious.

The solution to the problem lies in consensus. Where every one is affected by standards, every one should make the standards. Every group substantially concerned—manufacturer, designer, distributor, seller, consumer, and the Government—should have the right to participate in deciding what the provisions of a standard shall be, and none should dominate the decision at the expense of another. For if a standard is to be of any value, it must be generally acceptable to all who use it. Industries, like people, are most willing to abide by regulations which they set up themselves.

The 30-year record demonstrates that voluntary standardization is an entirely workable and practical system. The American Standards Association, with headquarters in New York, is unique in this field and may be called private industry's answer to the challenge of Government control of standards activities. It was founded in 1918 by five of the country's leading engineering societies and three Government departments—War, Navy, and Commerce—to bring order to the confused field of standardization. It now comprises 108 technical societies, trade associations and groups of such organizations, and some 2,200 private companies.

"If a standard is to be of any value, it must be generally acceptable to all who use it. Industries, like people, are most willing to abide by regulations which they set up themselves."

Functions of A.S.A.

It works to simplify developments of engineering, commercial, consumer, and safety standards; to eliminate duplication, overlapping, and variables of standards activities by other standardization bodies in the country; to promote knowledge and use of standards; and to serve as a clearinghouse for information on all standards in the country. It serves as the channel of cooperation with the standards bodies of the twenty-nine other nations which belong to the International Organization for Standardization.

Since 1948, and particularly since the attack on the Korean Republic, the American Standards Association has been engaged in an increasing amount of work directly concerned with or related to the country's program for rearmament.

In working with the Federal Government for more than thirty years with a notable degree of harmony, it had already developed a formula for an effective coöperative relationship. As many as ten Federal departments and agencies at one time were A.S.A. members, and as many as sixty-four agencies have participated in the work of its sectional committees.

The Directorate

Three directors and an associate director of the Bureau of Standards have sat on the board of directors of the American Standards Association, the Bureau itself helping to write nearly half of all American standards.

However, there is now a heightened danger that the intensified pressures of preparedness will cause the consensus principle in standards to be thrown out and war standards handed down by dictate.

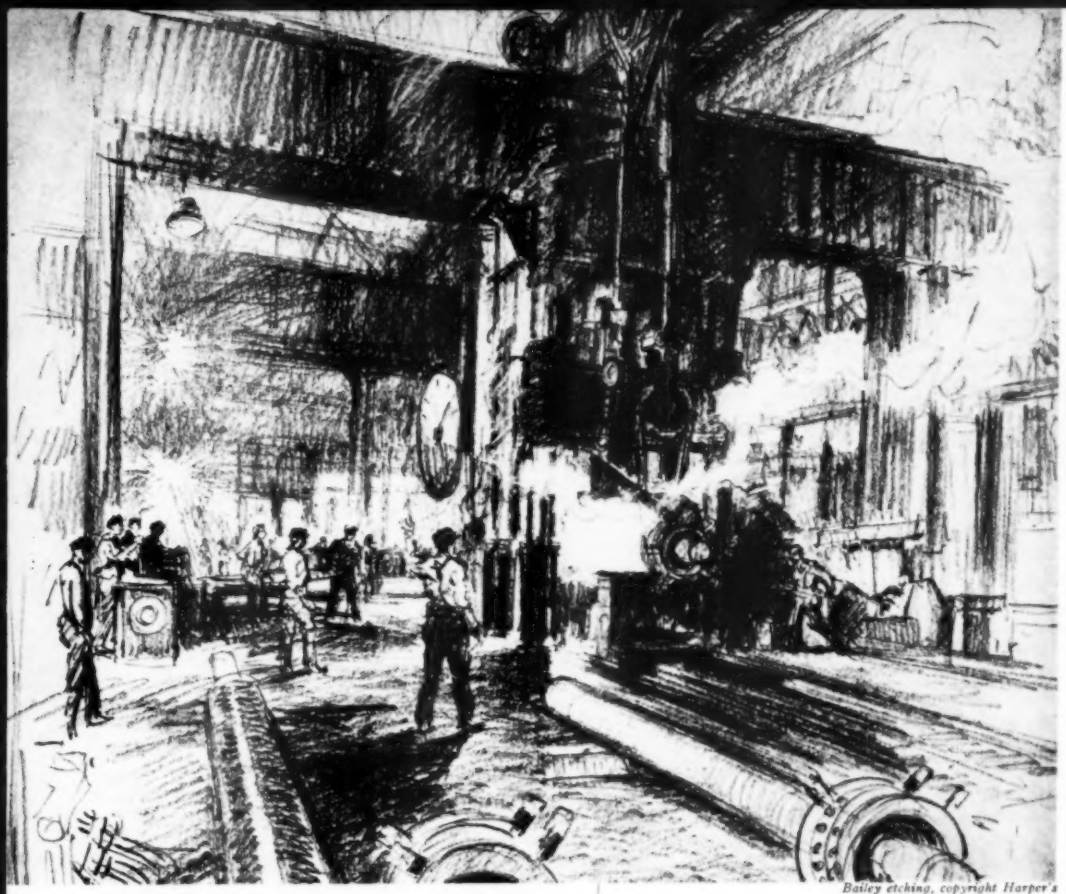
There is a greater danger that the Government, using the war emergency as an opportunity and an excuse, will not only take over full powers in standards activities but will fail to relinquish them when the emergency ends.

There is a group, both in and out of Government, who feel that standardization is properly a Government responsibility.

I think that neither now nor later can we afford such a reversal of our economic and technical processes. Our standards are now basic to our industrial economy. They will be more important than ever as we organize resistance against aggressive forces. When this crisis ends, we must work to achieve a higher degree of harmony and order in our world; to relieve the strain of modern living by simplification; to increase the standard of living through more efficient production of interchangeable parts in a free market.

Voluntary Agreements

I say that this is not work for the master planner. Creative dynamic standards are not composed on the higher levels and handed down by decree and proclamation. They are formulated by the voluntary agreement of all groups concerned, and must be worked out by the people themselves.



Bailey etching, copyright Harper's

Men and Management

The Armed Forces Should Adopt Approved Business Methods

by

Robert E. Wood

"There has been too much centralization and too many rigid controls. The only way for a very large organization to function is to decentralize, to delegate real authority and responsibility to the man on the job."

TODAY, management is the most important factor in the success or failure of American corporations. For over one hundred years the astonishing growth of the United States and its great natural resources made it relatively easy for men of industry, courage, vision, but sometimes with mediocre minds, to become rich in this great, growing country.

Keener Competition

Today, the era of exploitation of natural resources is almost over, and, with the increasing age of the country, there is keener competition. It now takes a much higher order of managerial skill—what we may call scientific management—to cope with the keen competition and above all with the very rapid changes of conditions in the industrial world.

Today, research is necessary in every phase of industry. If a product is not properly designed or engineered, its producers will fall by the wayside. In

General Wood is chairman of the board of Sears, Roebuck and Company, Chicago, Ill.

the field of distribution, it is the same.

As war is the oldest business of men, so is the military organization the oldest form of organization. Every business organization, as it grows larger, tends insensibly to take on many of the features of the military organization. The same problems come up, the perennial conflict between line and staff, the same conflicts between departments for power and authority.

Management Defined

I would define management in industrial life as the over-all administration of an enterprise, the control of men, materials, and machinery toward the ultimate objective, which in industry means either the production or distribution of a product, with a final profit.

With the growth of large American corporations, skill in management—administrative skill—becomes more and more important.

It is easy to get specialists; it is more difficult to get men with general administrative ability. As we grow older, the more we realize that the old copybook maxims had a solid foundation; for instance, "There is always room at the top." It is far more difficult to find the man to fill a $50,000 a year job than a $5,000 a year job.

The one lesson I have learned during my business life is that, while systems are important, men are more important; that the choice of men is all-important—the choice that places the right man in the right job. There are very few problems that cannot be solved by getting the right man in the key place. The same is true of a military organization.

Management is all-important in business organizations, large and small. The analysts of the great banks and investment trusts are finally learning that the character and ability of the management of a company are far more important than the balance sheet and operating statement. A good man can pull a company out of a difficult situation; a poor man can wreck the best company in the world.

That is why in every modern large corporation the personnel department and its head have become of increasing importance, for it is responsible for bringing bright young men into the organizations, watching their progress, seeing that they are assigned to the jobs for which they are fitted, and looking out for their advancement.

When a key position is made vacant, it is the duty of the personnel department to make recommendations to the chief executive as to the filling of the position.

In this respect an industrial organization has an easier task than a military organization for it does not have, at least in the same degree, the problems of rank. Seniority has its place in industrial organizations, particularly in the rank and file, but for the important top positions, civilian management has a far greater degree of flexibility than the military organization.

"Industry is ready and anxious to stand behind the military and to supply whatever it needs to carry out its mission."

As a business becomes larger and has branches all over the country, it becomes impossible for the executive to follow it and to control it except by figures.

These figures have to be carefully and rapidly compiled, to be available immediately, and the executives must be able to interpret them properly—to read behind the figures. That is why the comptroller of a large merchandise business is one of its more important executives.

Figures Necessary

In my own company, with eleven mail-order plants, six hundred and fifty-five retail stores, and thirty manufacturing plants in the United States and stores in Cuba, Mexico, Venezuela, and Brazil, it would be utterly impossible to control and administer the company without these figures.

Executives, of course, must follow up the figures by frequent inspection trips and contact with the field. No enterprise can be run entirely by reports and figures. The same is true of a commander of an army in the field. No matter how good his staff, he must maintain his personal contacts.

To my mind, the principal weakness of our defense organization in its supply and technical bureaus is its total lack of the proper figures—its total ignorance of costs.

You cannot expect an army in the field to keep an accounting force. You can, however, have proper figures and costs for the supply and technical establishments in the United States—the Air depots, Ordnance depots, shops, and Navy yards.

Perhaps if we had a simple cost and accounting system for these establishments there would be less waste in the defense organization and a better control of supplies.

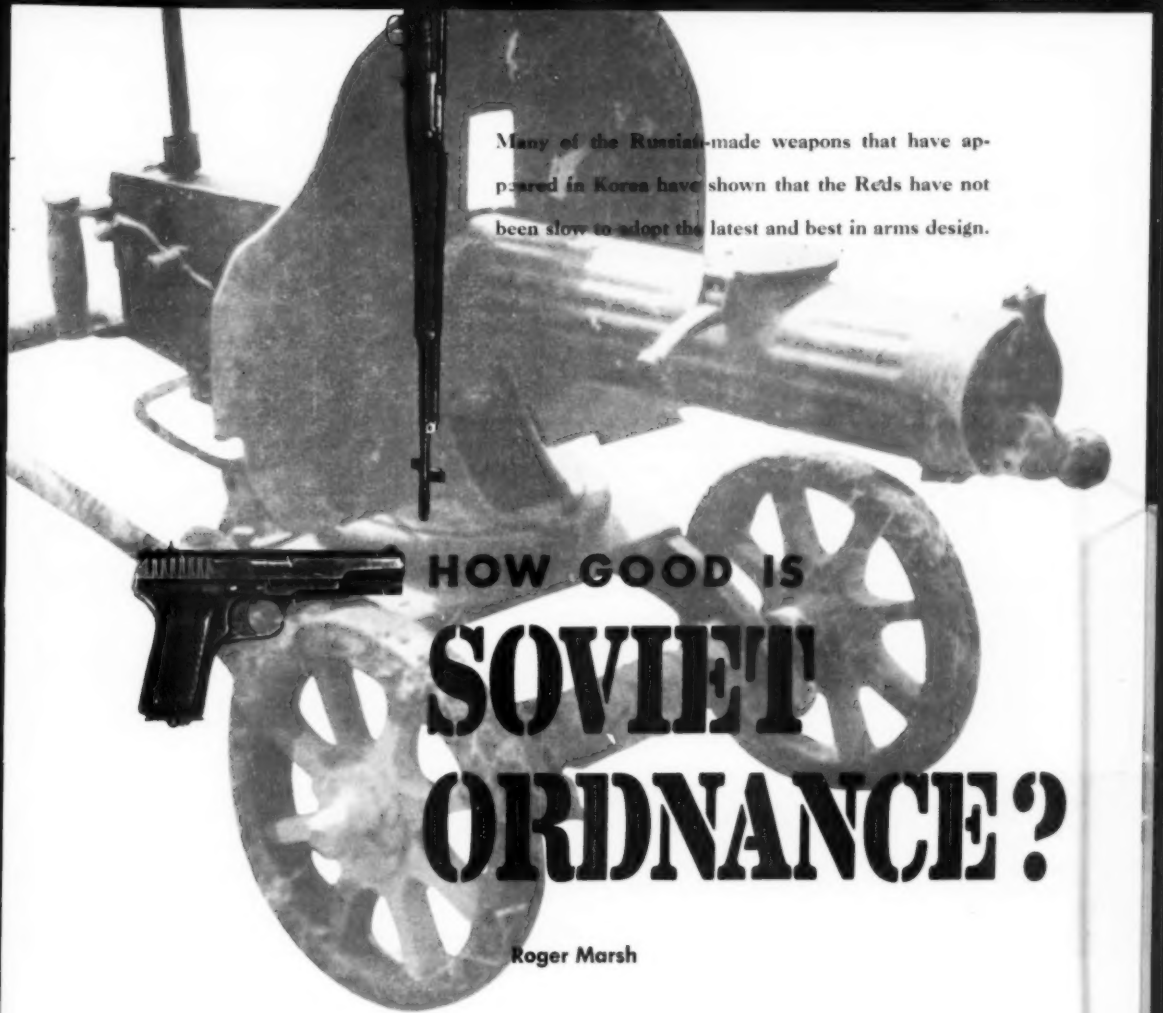
Too Many Controls

The managements of the large corporations of the United States have made the same mistake as the Government of the United States—there has been too much centralization and too many rigid controls. The only way for a very large organization to function is to decentralize, to delegate real authority and responsibility to the man on the job. But be certain you have the right man on the job. Again this involves the personnel department and the vital importance of its selections.

In any period of war or national emergency there must be close cooperation between industry and the military establishment. Industry is ready and anxious to stand behind the military and to supply whatever it needs to carry out its mission.

Effective liaison between the two is essential if industry is to furnish the full measure of support of which it is capable. The officers who are responsible for this liaison will need to understand the industrial problems of management as well as the strategic problems of the military.

Only by that means can they help build the kind of teamwork and cooperation that is more essential today than ever before.



Many of the Russian-made weapons that have appeared in Korea have shown that the Reds have not been slow to adopt the latest and best in arms design.

HOW GOOD IS SOVIET ORDNANCE?

Roger Marsh

SOVIET weapons at the close of World War II—and as some of them have subsequently appeared in Korea—represent the end product of more than half a century of intensive and nearly constant arms development.

Russia, whether under the tyrannous oppression of the Czars or under the "enlightened" guidance of the Politburo, has been alert to the latest in arms designs.

Furthermore, neither Czarist nor Soviet Russia was unwilling to seek abroad for arms designs, although it must be noted that recent Soviet Russian domestic arms developments have apparently been ample to supply service needs without recourse to imports.

The Moisin-Nagant

The oldest arm still in service is the Moisin-Nagant (variously spelled Moisin, Mosin, Mossin, or Mouzin) of 1891, a bolt-action, box-magazine weapon which did not make up in ease of operation for what it lacked in beauty. It was an outgrowth of the action of the Moisin and the magazine of the (Belgian) Nagant, rifles submitted to the testing committee set up in 1888.

The Moisin action has the usual two opposed lugs of ordinary bolt actions, but in the Moisin they are horizontal when locked. Because of the use of rimmed cartridges, and because the lower (when unlocked) lug of the bolt passes along the top of the magazine during bolt operation, it has been necessary to incorporate a sort of interrupter in the magazine to prevent interference of the cartridges either with each other or with the bolt.

The original Moisin 1891, recognizable by its use of sling swivels on the upper band and magazine body, was first made at Chatellerault Arsenal in France under contract while Tula and Sestroretz Arsenals were tooling up. The French-made arms were reportedly being delivered as early as 1892, but

it was not until around 1895 that the active Russian army was fully rearmed, its older 10.66-mm. Berdans being finally retired.

Rifle Series

A series of rifles along the general 1891 pattern was brought out during the 1890's and early 1900's, including the "dragoon rifle" (a slightly shortened version of the original 1891 with no swivels but with sling slots through the stock) and the carbine of 1910. Some of these, the 1916's, were made in the U.S. at the "Remington Armory."

Pre-Red-Revolution Moisins are easily recognized by their octagon-section receiver rings. The first redesign of the Moisin by the Soviets incorporated a round, and therefore more easily fabricated, receiver ring. The main result of this work was the Soviet 1891/30 rifle, adopted in 1930, although it was preceded by a similar carbine, the 1924/27. At least one special carbine was worked up during World War II, but this lacked the permanently attached folding bayonet reliably reported to be an official feature of the most recent Russian carbine.

The Moisin has never been noted as a target weapon, and its performance in such dress rehearsals as World War I and the Spanish Civil War indicated that it was a sturdy and reliable but somewhat unhandy arm, yet it still remains a first-line rifle in the Red Army—and in the army of at least one satellite.

Official Sidearm

The official sidearm of Russian—both Czarist and Soviet—troops was for many years the remarkable Nagant revolver, a device borrowed from such earlier designs as the Collier and Savage revolvers, in which the cylinder revolved as in a conventional arm but also reciprocated in order to provide an improved gas seal, the mouth of the cartridge case (the bullet is completely enveloped in the case) entering the rear end of the barrel.

The Nagants were retired from general issue after the first World War, although they continued to be manufactured at Tula, a special batch in caliber .22 rim fire being run off around 1935. This retirement was, however, rudely interrupted when Nagants were used to arm civilians and civilian guerrillas during World War II.

Revolvers Imported

Numbers of other revolvers were imported into Russia and used more or less extensively as police and civilian weapons, but none of these threatened the official position of the Nagant. Around 1905, however, Russian revolutionaries imported considerable quantities of Schwarzlose 1898 pistols, all of which were either seized at the border or captured when the 1905 revolution fizzled, being later reissued as police arms. These weapons, chambered for a cartridge identical in dimensions with the present service pistol and SMG case, began the Russian move toward automatic hand weapons.

Thus awakened to the virtues of automatic pistols, the Russians became such good customers of the postwar Mauser plant that the Mauser 7.63-mm. export pistol of 1920 became generally known as the "Bolo Mauser," and by 1929 it was generally conceded that the Nagant had been almost entirely replaced by this arm. Shortly thereafter, however, the Tokarev 30 was adopted (see illustration on page 75). This small and effective pistol, patterned after the basic Browning design but considerably simplified and improved, ultimately became the general-issue sidearm, a position which it still occupies, even though the rôle of the one-hand gun in Soviet service appears to be a very small one indeed in this day of "a machine pistol for every soldier."

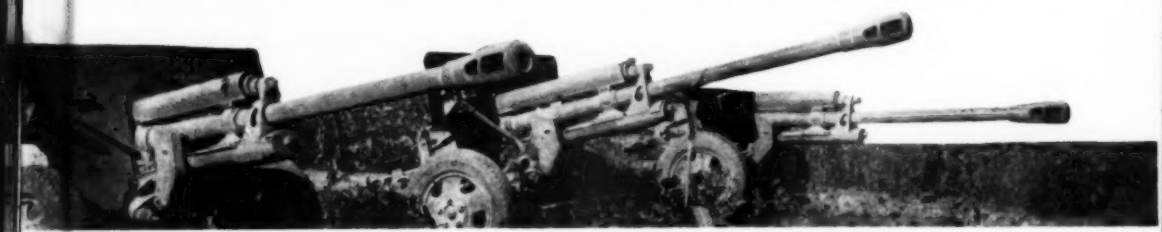
The 7.62-mm. Cartridge

The Russian 7.62-mm. autopistol cartridge, whose case is interchangeable with the cartridges used in the 7.63 Schwarzlose and 7.63 Mauser, was speedily standardized as the official Russian machine-pistol cartridge. Some loads giving almost 1,500 foot-seconds have been encountered, and green-nosed tracer loads, also black-red-nosed AP/I projectiles, were developed for the machine pistols.

It is now generally felt that European adoption of submachine guns or machine pistols was a result of the use of such weapons during the South American Gran Chaco War rather than of such use by Germany and Italy during World War I. The basic Bergmann 1918 gun of World War I was again used in the Gran Chaco, as were the newer Vollmer and Schmeisser weapons. The adoption by Belgium and Austria of service submachine guns in 1934 is laid to their study of the use of such weapons in Paraguayan and Bolivian service, and there is little doubt that Germany's decision to standardize the MP 38 (after using the redesigned BMP 34) was an outgrowth of the same general studies.

Machine Pistol Adopted

It has since become apparent that Russia, too, was watching the use of



Three 67-mm. antitank guns captured from the North Koreans on the Naktong River front.

machine pistols elsewhere in the world, since her adoption and subsequent redesign of the model 34/38 gun certainly compares favorably to the action of other nations.

The 34/38 gun was made and issued in limited quantities. It was reported to have a cyclic rate of 900 rounds a minute, certainly too high for its 25-round box magazine, and it was soon superseded, although photographs indicate that a few of the 34/38's, some with a special drum magazine, were used during World War II.

Tentative Steps

Russia's adoption of the 34/38 gun appears to have been a tentative step: when the Red Army moved into Finland in 1939, Soviet submachine guns were almost conspicuously absent. Perhaps the initial Russian difficulties in Finland were the result of an unfortunate attempt to democratize the army, perhaps to the terrible cold—but certainly the Finnish Suomi pistol, a superb machine pistol designed by Aimo Lahti, played its part.

Once the Russians really got rolling, they smashed the so-called Mannerheim Line and secured a peace and numerous concessions from Finland—yet perhaps more valuable than the Rybichi Peninsula and Hangoe was the lesson learned by the Red Army about the effectiveness of machine pistols.

Replacing the high-cyclic and hard-to-make 34/38 appeared the PPD1940, a simplified conventional submachine gun patterned basically after the Bergmann but with a drum, obviously inspired by that of the Suomi, holding 71 rounds. The cyclic rate was cut to around 600 rounds a minute.

The Degtyarov PPD1940 was conventional—its machined tubular receiver, for example, demanded time on machines needed for other purposes. The result was the PPSh (for Shpaghin) 1941, a pressed-out device of little beauty but great utility (see illustration at top of page 79). The receiver of the PPSh is so divided that the barrel, barrel guard, and upper half of the receiver may be rotated around a pivot ahead of the magazine cut, permitting the bolt to be lifted out.

The PPSh continued to use a 71-round drum, and it is still manufactured practically unchanged except that the receiver body is "beefed up" in the area where it is weakened by the drum-magazine slot. A 35-round box magazine was produced for this weapon late in World War II, but apparently it has not made its appearance in Korea.

A simplified version of the 1941 appeared in 1942 as the PPS (Sudarev), a folding-stock, 7-pound blowback weapon with 35-round box magazine, reportedly designed for paratroop or airborne infantry use. Since Soviet paratroops were thrown into ground service as elite shock troops and Guards battalions several times during the war, both the 1942 and the 1943 were encountered in ground service. Since the war, however, the Soviets have reconstituted their airborne organizations, and both types of the PPS are generally issued within them.

Weighs But Six Pounds

The two arms are practically identical, but the 1943 has a one-piece barrel guard and receiver. The 1943 model is reported to weigh only six pounds, a reduction probably resulting from elimination of assembly and bracing blocks. The 1942's stock, when folded, saddles its shoulder piece over the receiver around the ejection port, while the stock of the 1943 folds so that its shoulder piece surrounds the rear sight, behind the port. The 1943's stock latch is simplified.

The submachine gun or machine pistol is apparently becoming the most generally issued weapon of the Red Army. It seems to have replaced the Tokarev pistol almost entirely and may be on its way to replacing, at least in part, the infantry rifle.

The Soviets early recognized the advantages of an autoloading individual weapon. Before they undertook extensive submachine-gun development in 1940 and after, they had adopted an autoloading rifle in 1936 and turned to an improved design in 1938.

The Simonov Rifle

The Simonov rifle of 1936 was a rather complicated and hard-to-manufacture design which apparently proved unsatisfactory when placed in service. Its 2-piece bolt, whose lower section supported the cartridge and was held by the bolt lock while the upper section served as a locking cam and cocking mechanism, was ill-adapted to use in an army whose duties took it into extremes of climate, the more so since it was fully exposed. The Simonov had a very effective muzzle brake, and it introduced into Russian service the type of nozzle and cup gas system mounted above the barrel which later became standard in the Tokarev.

When the Tokarev of 1938 was introduced, it was found to have a superficial resemblance to the earlier Simonov—but its breech mechanism was entirely different. The Tokarev uses a tilting bolt whose rear end is cammed down against a locking shoulder by the bolt carrier, which also serves as a bolt cover, carrying the bolt handle. The gas-piston rod, which passes through the receiver ring below the rear sight, drives back the bolt carrier to unlock and retract the bolt after firing. An internal hammer fires the weapon, and a unique dual-sear mechanism, combined with a most effective disconnecter mechanism, prevents accidental machine fire. The secondary sear makes possible the

A North Korean tank knocked out and "decorated" by the 25th U.S. Infantry Division near Taegu.

adaption of this arm to full-auto fire, if desired.

The Tokarev Rifles

The Tokarevs of 1938 had 2-piece stocks, cleaning rod on the right side, long wood upper handguard, short metal upper guard, and solid magazine latch. In 1940 a new series was introduced with a shortened one-piece wood stock extended by a lower metal handguard, a short upper wood handguard and a lengthened upper metal handguard, cleaning rod below the barrel, and folding magazine latch (see illustration at top of page 75). In all the Tokarevs the muzzle brake, front sight, bayonet stud, and gas nozzle are combined in an assembly which screws over the front end of the barrel and is keyed in place.

Reportedly, the earlier Tokarevs had muzzle brakes with eight slots to a side, while 1940's had six slots. A final form, apparently brought out about 1942, dropped the slotted muzzle brake and introduced one with two large ports on each side. An interesting carbine on the Tokarev system was brought out in limited quantities in 1940. Variant forms of the Tokarev, intermediate between the 1938's and 1940's, have been noted. The 15-round magazine of the Simonov was trimmed to ten rounds for the Tokarevs; it may be replaced or recharged from standard rifle chargers.

Cold Weather Action

Reportedly the Tokarevs had a habit of freezing up in extremely cold weather, and a frostproof oil was brought out to correct this. It has been reported that production and issue of Tokarevs was stopped before 1943, but the discovery of a Tokarev produced in 1944 makes this seem unlikely. Do not sneer at the Tokarevs which froze at "forty below"—remember that *our* rifles and machine guns with ordinary lubricants quit as though soldered up solid in Korea!

The nonappearance of Tokarev rifles in Korea has led to considerable speculation.

Pre-World-War II Russian snipers trained with the heavy and cumbersome 4-power PE scope. Fitted with either 2-piece bridge mounts or a monobloc receiver-ring mount, it was used extensively on Moisins with special turned-down bolt handles. This combination accounted for many a Nazi during the Second World War. The PU scope, 3.5X, which appeared somewhat later, was used on the Moisin with a one-piece mount but was more generally used on selected Tokarevs. It was quite short and so did not interfere with automatic ejection, and it was light enough so that it could be successfully mounted in a one-piece "pillar" mount which did not interfere with use or cleaning of the arm.

As with telescopes, development of bayonets continually progressed in Russia from the old triangular-section Berdan sticker, as modified for use with the Moisin, through the long Simonov knife bayonet of 1936 and the Tokarev knife of 1938 to the short Tokarev bayonet of 1940 . . . and then back to the Moisin again! The new attached folding bayonet of the latest Moisin carbine probably represents the final stage.

The first truly Russian automatic weapons development was the DP Infantry Degtyarov of 1928. This arm, the invention of the late great V. A. Degtyarov, is truly one of the finest light machine guns ever developed.

Work on this gun was begun in early 1924, and late in that year the first models were tested against rival light machine guns (both adaptions of the water-cooled service gun), the Maxim-Tokarev and Maxim Kolesnikov. Unfortunately, the Degtyarov was disqualified by breakages and the Maxim-Tokarev went into limited test service. This service, however, disclosed that the Maxim-Tokarev, too, needed redesigning, which would have destroyed its major virtue (using existing parts), and retests were set up.

Vastly Superior

Extensive redesigning of the Degtyarov had greatly improved it, and on the new tests it proved to be vastly superior to its opponents.

Several versions of the basic DP gun were developed, among them the DA aircraft gun (with the peculiar umbrella muzzle brake), the DT tank gun developed from the DA, and subsequently a later type of DT with plain barrel from which a ground modification was worked up. The original DA's, supplanted by the Schkass 1935 and 1936, went into naval service, their muzzle brakes replaced by flash-hiders, on patrol boats in World War II.

Although the DP and ground-modified DT guns saw extensive use on land, it became apparent that they required some redesigning. The DPM and DTM guns were the result—modernized versions of the earlier models with the driving springs removed from beneath the barrels, where barrel heat in continued firing reduced their strength, to tubular housings at the rear of the receiver. The basic Degtyarov action (two locking flaps, one on each side of the bolt, whose rear ends swing out to engage shoulders in the receiver) remains practically unchanged, however.

Although the pure DPM has not been encountered in Korea, both tank and ground-modified DTM's have turned up. The belt-fed Model 1946

Small antitank gun used against U.S. troops and vehicles in Korea.

light company gun on the Degtyarov action, reliably reported to exist, has so far remained invisible.

A ground-modified DTM complete with a scope sight (apparently neither PE nor PU) was found in Korea, however, and others of these arms without the scope but fitted with the scope mount have also been captured.

The heavy Maxim used by the Russian-satellite North Korean government is of the type used in Russian service since 1905. Imported Maxims, using the high tripod of the period, were used in the Russo-Japanese War: the arm itself was so satisfactory that its design was taken as standard for arms to be made at Tula Arsenal, but the tripod put the gunner so high in the air that he was strictly a sitting duck. Colonel Sokolov designed a wheeled mount with shield which was so good that its basic design has remained in service to date and has inspired similar mounts for such arms as the 1938 DK and 1943 medium.

The 1905 Maxim

The original Maxim of 1905 used bronze for several major parts, such as the water jacket. Its dry weight of 63½ pounds was reduced to 40 pounds in the Maxim 1910, which used steel instead of bronze. Both fluted and plain water jackets have been noted in the 1910. While the obsoleted 1905's were in some cases probably converted, it is known that some of them were retained in naval service even after the Revolution.

Various minor modifications of the 1910, such as two different types of recoil booster, are known. A .22 training attachment with a drum magazine somewhat like that of the Robbins .22 Thompson training attachment was made and issued.

Late in World War II the Russians worked out what has come to be known

Front to rear: 7.62-mm. PPSh 1941 submachine gun; late-type 24/27 carbine; Japanese 7.7-mm. rifle; Degtyarov DP 7.62-mm. machine rifle; PTRD 1941 Degtyarov 14.5-mm. AT rifle; 7.62-mm. "trapdoor Maxim"; M1938 heavy Degtyarov 12.7-mm. machine gun.

Russian-made T-34 tank knocked out by American forces in Waegwan, Korea.

Light North Korean field gun captured by U. S. troops.

Russian-made 120-mm. mortar captured somewhere in Korea.

Shown below are two Russian-made self-propelled SU-76 artillery pieces. The guns are 76 mm. mounted on a full-tracked vehicle with medium armor.

Comparison of Russian (left) and U.S. rifle and pistol ammunition and clips.

as the "Trapdoor Maxim"—a standard 1910 gun except for a large filler port in the top of the water jacket, making possible the easy refilling of the jacket from canteens or other containers (see illustration on page 75). This, unlike the little charcoal stove which the Russians once issued so that the gunner could strap it to the water jacket of his gun and thus keep it from freezing, seems to be a permanent improvement.

Sokolov Mount

The Sokolov mount has also been improved, particularly in its elevation adjustments. An "improved" mount, like the 1938, was brought out in 1931, but it was not widely used.

A light version of the Maxim, the air-cooled Maxim-Tokarev, was made and issued for field test around 1924 but was displaced by the DP. Photographs of Chinese troops during World War II showed that the Soviets had unloaded their Maxim-Tokarevs in China.

The Degtyarov 1939

An attempt was made in 1939 to supplant the Maxim and Sokolov mount with the medium Degtyarov and the 1939 tripod mount. The medium Degtyarov 1939 was a gas-operated, air-cooled, belt-fed weapon using the Degtyarov locking-flap system. It offered two rates of fire, about 550 rounds a minute for regular use and around 1,100 rounds for antiaircraft fire. The arm was complicated and hard to make, and it apparently found little favor in service. Although both the gun and mount remained in service until 1943, and although a snow-sledge version of the mount was worked out, it had become apparent as early as 1941 that the arm was unsatisfactory.

The 1939 mount incorporated recoil-absorbing slides of the type developed for the 1938 DK, and the bullet shield of the earlier Sokolovs was an added feature.

The 1943 medium (Goryunov) gun and mount were immediately successful. This gun, like the DPM, is one of the best in its class. It has a very simple belt feed, a simplified breech mechanism, the rear end of whose bolt tilts into the right sight of the receiver to lock, and a quick-change barrel. The elevation, traverse, and recoil-absorbing features of the 1939 mount were combined with an improved shield mount and a modernized wheeled folding trail to make the 1943 mount.

An auxiliary pintle fork is incorporated at the tail of the trail, so that the mount may be swung up to rest in its wheels and shield, the trail sticking straight up in the air and the gun being mounted in the fork.

Antitank Rifles

Individual antitank rifles have long been a feature of Red Army equipment, but the two 12.7-mm. AT rifles of the 1930's, patterned after the World War I German "T-Gun," were not considered very good and were dropped in 1939. Two years later both Simonov and Degtyarov brought out antitank rifles using the extremely powerful 14.5-mm. cartridge, giving 3,280 foot-seconds with 991-grain bullet (see illustration at top of page 81).

Simonov's antitank rifle was simply a 44-pound scaled-up version of the Tokarev rifle, a semiautomatic arm with 5-round magazine which could be broken down into two loads for carrying. Unlike this PTRS, the Degtyarov

Left, a DSK 1938 dual-purpose 12.7-mm. machine gun shown here detached from its wheels and set up for antiaircraft fire.

U.S. caliber .30 Browning light machine gun for comparison with Russian gun at right.

A 14.5-mm. PTRS 1941 anti-tank rifle. Note the unique 5-round clip and muzzle brake.

PTRD was a single-shot weapon which gave automatic unlocking and ejection with greased ammunition but which had to be manually reloaded and locked. Its 33 pounds gave the gunner a rather heavy load, but it could punch through 30-mm. armor at 100 meters.

Heavy Machine Guns

The 12.7-mm. DK and D/Sh/K heavy machine guns, using the Degtyarov locking-flap system, have been entirely successful. These gas-operated weapons, fed by nondisintegrating metallic-link belts, have an effective rate of fire of more than 550 rounds a minute. A massive wheeled mount, complete with shield, is provided. The wheels and shield may be removed, after which the trail of the mount opens out to form a high antiaircraft tripod mount (see illustration at bottom of page 80).

Soviet aircraft guns are very good. The early DA Degtyarov was supplanted in 1935 by the early Schkass (Schpitalny-Kamourutski), which was replaced by an improved version in 1936. The Schkass is unique in many respects. The belt passes almost entirely around the gun on a feed cage, the cartridge being extracted from the belt by a helical cam.

A scaled-up version of the Schkass in 12.7-mm., using the rimmed case, is known as the SchVAK. While the Schkass is known in fixed (29.3-inch barrel) and flexible (23.7-inch barrel) versions, little similar data are available on the 12.7-mm. SchVAK which apparently to a large extent has been replaced by the simpler UB and BS guns using the rimless 12.7-mm. cartridge introduced in the DK 1938.

The standard Russian 20-mm. gun is the big SchVAK, using a rimmed straight-sided 20-mm. case not encountered elsewhere in Russian service.

The Volkov-Dzhareev

The most powerful Russian aircraft automatic gun generally used in World War II was the 23-mm. Volkov-Dzhareev, a recoil-operated gun delivering a 3,017-grain projectile at 2,950-3,000 feet a second.

Since World War II the Russians have had the benefit of such German developments as the Mauser MG213/C/30-mm. gun and the MK214 5-cm., not to mention the 30-mm. MK108. The 1,100 r.p.m. cyclic rate of the MG213/C gun in its 30-mm. version is remarkable.

Of the Russian arms in use at the close of World War II, many have been encountered in North Korea. Most common have been unmodified DP's, DTM's (both in tanks and ground-modified), PPSh 1941's of the latest manufacture, service rifles such as the 1891/30 and 24/27, and, of course, the latest trapdoor Maxims, some made in 1945.

DTM Degtyarov 7.62-mm. tank light machine gun with modernized recoil-spring housing and collapsible stock.

Heavy Degtyarovs of the earlier pattern—with the umbrella muzzle brake—have been encountered in quantity and they seem to be the standard Communist heavy machine weapon.

In the early days of the fighting, few reports were allowed to leak back to this country about the effectiveness of the Goryunov medium 1943 gun. Both as a ground weapon and swung up for antiaircraft fire this gun and mount make a most remarkably effective combination. The Goryunov is probably the simplest belt-fed medium machine gun ever designed, and this is one time that simplicity and excellence go hand in hand. We could do much worse than to investigate the possibility of an adaption of the Goryunov.

Curiously, however, the Russians have not supplied Tokarev semiauto rifles to their North Korean friends, neither have they given them any of the 1942-1943 machine pistols. On the other hand they have turned over such ancient items as the old Winchester 1895's in 7.62-mm. Russian which were bought for World War I service. And although they have supplied quantities of the excellent Goryunov, they have not let out anything more than rumors about the Model 1946 company gun.

Russian Enigma

It's hard to understand just where, how, and why the Soviets drew the line. Some of the equipment which they supplied seems second-line stuff, and therefore one might logically expect them to turn it over. Yet, on the other hand, they have given the North Koreans items which certainly seem first-grade, notably the 1943 medium.

This seeming inconsistency has given rise to such conjectures as that concerning the Tokarev: it is felt that perhaps they had developed this weapon into a machine-rifle and are just waiting for the proper time to spring it on a waiting world.

ARMED FORCES STAFF

Its aim is to train officers who are qualified for high-level command and planning for joint military activities involving two or more of the armed services

Maj. Gen. Robert O. Shoe
Deputy Commandant
Armed Forces Staff College

DURING World War II there was a shortage of officers qualified for high-level command and planning for joint military activities involving two or more of the three services. The Army and Navy Staff College was established in 1943 to help fill this need.

The National War College and the Industrial College of the Armed Forces are postwar joint military educational institutions charged with preparation of selected officers of the armed forces for important command, staff, and planning assignments in the national military establishment.

Established in 1946

The Armed Forces Staff College was established in 1946 at Norfolk, Va., to promote the education of selected officers of the military services in the coördination of all arms in theater and other joint force operations. It is sometimes known as the Joint School of Combat. It is supervised by the Joint Chiefs of Staff, and the Navy is responsible for the operation and maintenance of the facilities used by the college.

Instruction at the college as directed by the Joint Chiefs of Staff includes: (1) Characteristics, organization, and employment of Army, Navy, and Air forces, and the relation of these forces to each other; (2) Joint staff technique and procedure; (3) Organization, composition, and functions of theaters of operations and major joint task forces, and the responsibilities (strategical, tactical, and logistical) of their commanders; (4) Preparation of plans for amphibious and airborne operations involving the employment of joint forces; (5) Trends of new weapons and scientific developments and their effects upon joint operations.

Students are selected from lieutenant colonels and colonels of the Regular Army and Air Force and equivalent grades of the Navy. They have outstanding efficiency and personality records and have backgrounds appropriate for high command and staff assignments.

Virtually all arms and branches of the three services are represented in the student body. The students in each course are allocated approximately equally to the three services and include officers who are assigned to or connected with Ordnance. About ninety-eight per cent of the students in current classes served in combat theaters overseas during the Second World War.

Two Courses a Year

The course is of five months' duration and is given twice each year. One course runs from September until January and another from February until June. The eighth course was completed in January 1951. The ninth course began in February 1951.

The position of commandant is

COLLEGE

rotated among the three services. Vice-Adm. John L. Hall, Jr., of the Navy is now the commandant. He succeeded Lieut. Gen. D. C. Emmons of the Air Force (the first commandant) in 1948. Admiral Hall has two deputies, Maj. Gen. R. O. Shoe of the Army, and Brig. Gen. R. C. Candee of the Air Force.

The faculty is selected from the older and more experienced officers of the three services. The faculty keeps in touch with the principal agencies of the services in order that instruction may be up to date and in accordance with approved policies.

Guest Speakers

In addition to lectures by the faculty, outstanding guest speakers address the college. The Chiefs of Staff of the Army and Air Force and the Chief of Naval Operations, or their top assistants when they are not available, address the students of each course. Many other flag and general officers also talk on their current activities. Distinguished educators and scientists address the students on matters pertaining to their specialties.

Graduate-school methods are used in the college, students being treated as responsible adults.

Student Staffs

Mornings are devoted to lectures, afternoons to seminars. For seminar purposes, students are divided into twelve committees, each committee having about fifteen members divided proportionately among Army, Navy, and Air Force officers. Student committees are organized into typical joint staffs with a student chief of staff, and normally work without reference to the service affiliations of their members.

Seminars and discussions stress the unified or joint approach to problems. A great deal is learned by direct exchange of information among students of the different services because all of them have had from ten to twenty years' experience in the problems peculiar to their service. Students keep up with current military events by attending frequent briefings and movies on the Korean situation.

Students attend special demonstrations of Army, Navy, and Air Force activities. During the eighth course they saw an airborne demonstration at Fort Bragg, N. C., in which personnel and equipment were parachuted to the ground. A tactical air support demonstration involving gunfire, bomb dropping, and rocket shooting was also observed at Fort Bragg. At the Norfolk Naval Base, they inspected an aircraft carrier, while the Naval Air Station at Norfolk provided a ground and air demonstration of naval aircraft. One day was spent at sea aboard a submarine. An amphibious landing exercise was witnessed early in the course.

Students are impressed by the university atmosphere of the college. Its location in Norfolk provides easy access to important operating service installations. Army Field Forces headquarters is at Fort Monroe just across Hampton Roads. Langley Air Force Base and the Tactical Air Command headquarters are only a few miles from Fort Monroe. The headquarters of the Atlantic Command and of the Commander in Chief, Atlantic Fleet, are in Norfolk. The Norfolk Naval Base, including the Naval Air Station, the Naval Shipyard, the Naval Supply Depot, and the Little Creek Amphibious Base are near by.

Graduates of the college should be well qualified for duty in a joint headquarters such as General Ridgway's or a combined headquarters such as the one which General Eisenhower is now in the process of organizing.

Wartime Example

The inextricably joined Army, Navy, and Air Force activities at the beachheads and ports and in the fighting areas in Korea illustrate the type of joint operations in which graduates of the college, other qualifications being equal, should be able to function better than officers who have not been trained in joint operations.

"I am satisfied that when the whole story of Korea is written it will be an epic of American courage unexcelled in American military history. From the first day, when two companies of the 24th Division stood all day in the rice paddies north of Taejon and fought off eight times their number in North Koreans until their ammunition was exhausted, to the dramatic defense of Taejon in which General Dean was lost, and back to the Naktong River with the great defense line established there by General Walker, our soldiers performed magnificently against every disadvantage. Then the Inchon landing with its superb coördination of sea, air, and ground forces, and the rout of the North Koreans all the way to the Yalu River . . . the inspiring leadership of General Ridgway—all this has put us in a position where American courage and leadership sustain American prestige throughout the world."
—SECRETARY OF THE ARMY FRANK PACE, JR., *in an address at Miami, Fla.*

The Korean campaign has once again shown that modern warfare calls for closest coöperation among the services, and graduates of the college are trained to make effective use of joint operations and new weapons.

A Bigger Job for Smaller Plants

How "Little Business" Can Aid the National Defense Program

James L. Kelly

WITHIN the last few months, the Nation, awakened to the peril facing it, has begun an unprecedented program of mobilization for defense.

The National Production Authority of the Department of Commerce is the agency of the Government which has been charged with the responsibility of seeing that the materials requirements of the program are met, with minimum disruption of the civilian economy. Obviously, the responsibility is an enormous and difficult one.

Equal Opportunity

The NPA is well aware that if it is to carry out its assignment successfully —if defense needs are to be met, and without serious damage to our economy in the process—small plants must have an equal opportunity to take part in the defense program. Further, they must be given the opportunity as rapidly as it is possible to do so.

This concern of NPA for small plants does not stem from a belief that, because of their smallness, they need coddling. Rather it is born of a knowledge that small plants are a major factor in our industrial might and an essential part of our economy. As a group, small plants produce thirty-one per cent of the total national output and employ about thirty per cent of all persons engaged in manufacturing in the United States.

"Small Plant" Defined

Perhaps it would be well, at this point, to state what we mean by a "small plant." Definitions vary, but the one that is most widely accepted in Government today is "a business which is independent and which employs fewer than 500 persons." This is the definition contained in the Armed Services Procurement Act and the Selective Service Act.

Criterion Too Rigid

The NPA believes that the criterion of 500 employees is too rigid. On the basis of data gathered by the Bureau of the Census and other organizations, public and private, it feels that no single numerical dividing point between large and small business will apply equally well to all industries. During the defense emergency, however, NPA does not intend to seek a change in the criteria.

So far the defense effort has worked a greater hardship on the small plant than on the large one. The NPA necessarily must preëmpt or earmark materials needed for defense items well in advance of the actual placing of contracts for the items. Time must be allowed for a change in the rolling schedules of metals and for a shift in the pipeline from civilian flow to military flow. The small plant is not as well prepared as the large plant to withstand this necessary lag between preëmpting of materials and awarding of contracts.

Until contracts begin to flow in increasing numbers and the small plant has a chance to obtain a prime contract or, more likely, a subcontract, for defense items, the problem will remain serious.

Further adding to the difficulties of the small plant is the fact that many contracts which it could handle satisfactorily now are going to large plants. True, the small plant cannot produce tanks or B-36's or similar major units of equipment. Nevertheless it can produce, economically and efficiently, many smaller items which today are being purchased from large plants.

Mr. Kelly is deputy director of the Office of Small Business, National Production Authority.

Program Would Suffer

If the present condition—lack of materials for their normal products and lack of contracts for defense items—were to continue and grow worse for small plants, the defense program eventually would suffer. The day would come when large contractors, their plants overflowing with orders, would hurry to find additional subcontractors among small plants. But the small plants would not be there. Unable to obtain materials, unable to obtain contracts, and consequently unable to keep his workers, the small-plant owner would have closed up shop and gone to work for one of the larger plants.

The NPA is responsible for averting this situation, for keeping the small plants in operation so that they can lend their weight to the defense effort. Through the Office of Small Business it is striving in various ways to obtain for small plants a larger share of prime contracts and an increasing number of subcontracts.

Daily Listing

One of the major ways in which NPA is endeavoring to increase the number of small prime contractors is through the publication of a daily listing or synopsis of invitations-to-bid issued by all major procurement agencies, both military and civilian.

The synopsis is distributed to all Department of Commerce Field Offices

and to over 6,000 coöperating offices throughout the country, such as chambers of commerce, trade associations, banks, and other public-interest organizations. Interested businessmen can obtain copies on a "pickup" basis from these offices. The synopses provide information on needed items, the desired quantities, locations of the offices making the purchases, and the opening dates for bids.

According to Defense Department officials, publication of the synopses resulted in a great increase in number of bidders last year and a consequent saving in the purchase of many items.

A second synopsis, published weekly, lists all Defense Department contracts which are of a nonsecret nature and which are for more than $25,000. This synopsis, also available from the 6,000 outlets, is especially helpful to the small plant owner in locating prime contractors who may need subcontractors.

Another phase of the NPA program is participation in a series of nationwide business clinics designed to better acquaint small manufacturers with methods of Government procurement and to aid in solving their individual problems. Some fifty of these meetings have been held and have proved extremely valuable both to the businessmen who have attended them and to the Government officials who have taken part in them.

Clinics Helpful

At the clinics, small manufacturers have obtained in two or three hours information that would have taken them several days to gather during a visit to Washington. In turn, the questions asked by the manufacturers at the meetings have helped in several instances in the development of Government policies.

Advising local communities on the formation of production pools is still another NPA small-business activity. These pools are made up of kindred types of manufacturing concerns, probably no one of which could handle a Government prime contract by itself, but which, operating as a group, have the necessary facilities. A number of pools performed very well during World War II. Perhaps the best known of them was located at York, Pa.

An NPA program which is now in the development stage, and which should bring small plants into the defense production picture on an ever-increasing scale, calls for the placing of a trained procurement specialist in each Department of Commerce field office to help worthy small plants obtain prime and subcontracts.

The NPA is, of course, constantly urging prime contractors to subcontract to as great an extent as is possible. In this it must rely for the most part on moral suasion. Through review and recommendation concerning applications for "certificates of necessity" and for direct Government defense loans, however, NPA is able to take concrete steps to discourage unnecessary plant expansion and thus to encourage subcontracting.

"As a group, small plants produce thirty-one per cent of the total national output and employ about thirty per cent of all persons engaged in manufacturing in the United States."

The ways in which NPA is endeavoring to make maximum use of smaller plants in defense production are sound ways and can go far toward achieving their objective. However, their effectiveness will be influenced to a large degree by the attitude of the small businessman himself and by the procurement policies of the Defense Department and its representatives.

For his part, the small manufacturer must realize that in the final analysis the job of obtaining a prime contract, or a subcontract from a prime contractor, falls largely upon him. Unless his is an unusual case, private industry does not bring contracts to him. He must obtain them through his own efforts.

The same will be true in his dealings with the Government and with prime contractors. He cannot sit back and wait for contracts to come to him. Instead, he must use every means offered to him to bring to the attention of Government purchasing officers and prime contractors the facilities of his plant and the types of products it can produce. In his effort, he will receive all possible assistance from NPA.

Nine Suggestions

For their part, the military procurement offices can do much to broaden the opportunity for the small plant to obtain contracts and to make selling to the Government easier and more attractive to the small businessman. Specifically they can:

1. Purchase as many items as possible on a competitive-bid basis. Smaller plants generally have the best chance to obtain a contract when it is awarded on a competitive-bid basis, enabling them to take full advantage of their economies of production.

2. Give small businesses the opportunity to manufacture needed smaller standard commercial items. If the military were to purchase all such items on a competitive-bid basis, most of the contracts would go to small manufacturers. If small plants were considered in negotiating purchases of the items, they would do very well on that basis, also.

3. Strongly urge prime contractors to subcontract as much as possible.

4. Consider small plants in the awarding of development orders.

5. Disperse contracts for major items to as great a degree as is feasible.

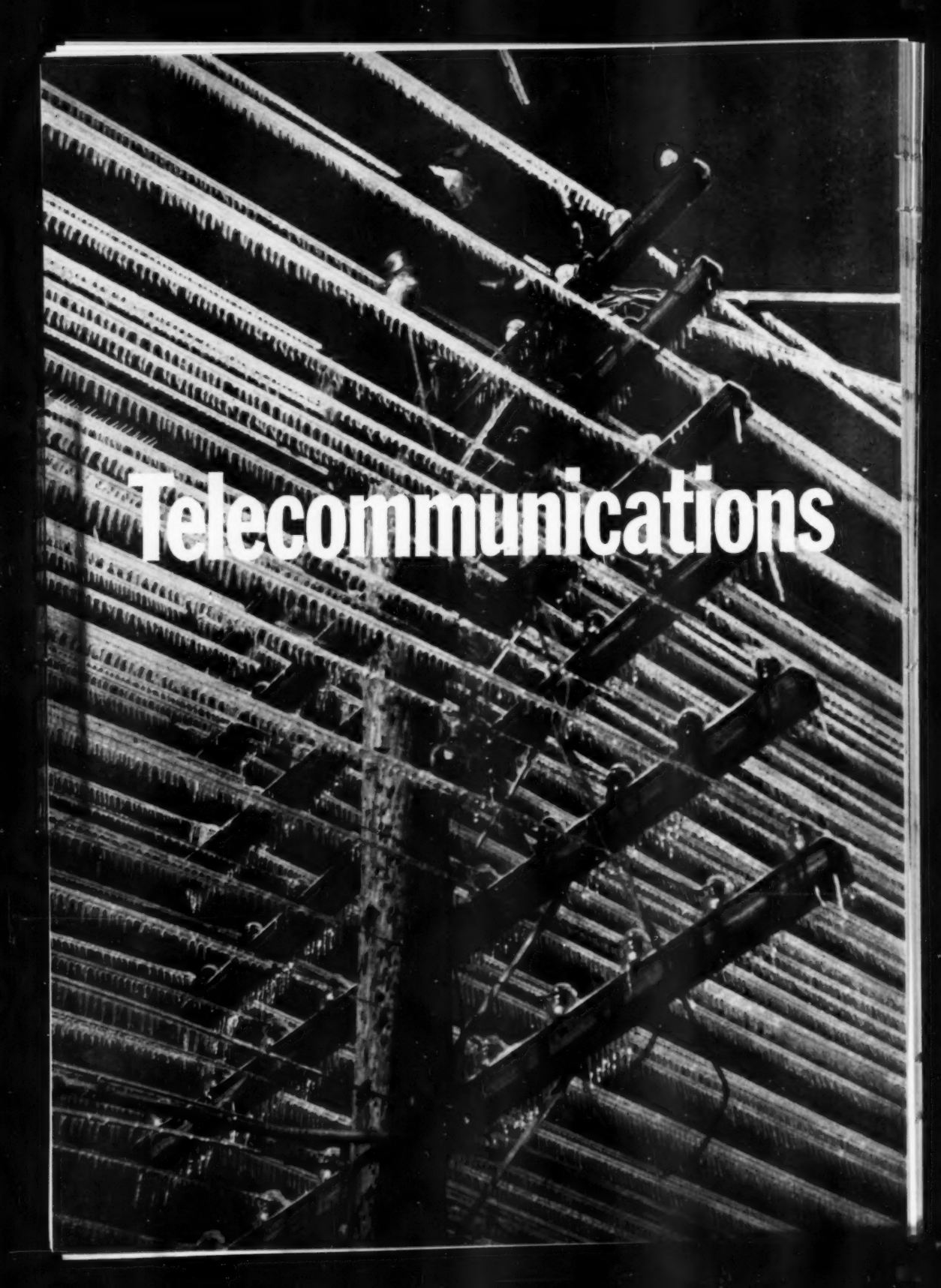
6. Simplify and standardize specifications.

7. Adopt less rigid and more standardized inspection requirements.

8. Give "progress" payments to small manufacturers while work is in process, and speed up payment when work is completed.

9. Bear in mind at all times that small plants have strategic importance as a great source of production and economic importance as the very lifeblood of many communities.

If the small manufacturer, the Department of Defense, and the National Production Authority work together closely, we can build a strong defense and at the same time maintain a strong system of free, competitive enterprise.


Telecommunications

by harold s. osborne

Chief engineer, American Telephone and Telegraph Company

TELECOMMUNICATIONS play a far more extensive and intimate part in the life of the entire population of the United States than in most other countries.

The United States has sixty per cent of all telephones in the entire world. Forty-three million telephones are now in service. There are twenty-eight telephones for every one hundred people. The ratio for Europe as a whole is only 3.4 telephones per 100 population.

The American telephone system carries 170 million telephone calls a day. The message telegraph system carries 500,000 telegrams a day. These telephone and telegraph services are supplemented by extensive private lines and teletypewriter services.

After the Texas City explosion disaster, construction crews from near-by Galveston helped local telephone men restore lines in the dock area.

During the Ohio River flood of April 1948, Marietta telephone repairmen checked the lines and made emergency repairs by rowboat.

Close Coöperation

The telephone companies of the country comprise two groups—Bell companies and independent companies. All companies in both groups work in close coöperation to provide a nationwide telephone service.

The Bell system operates 36.4 million telephones (85 per cent of the total) and most of the toll circuits of the country. It includes twenty-one associated companies which, taken together, cover the continental United States. The American Telephone and Telegraph Company is the parent company of the Bell system. It has ownership in varying degrees in all of the twenty-one associated companies.

Independent telephone companies have operating agreements with the Bell system for the interchange of business. With negligible exceptions, there is no competition between two companies in giving service in a specific locality. Independent companies operate some toll service between near-by independent offices. Most of the toll service throughout the Nation is given by the Bell companies.

The principal form of service given by the telephone companies is message telephone service, both locally (exchange service) and nationally (toll service). For both services dial operation is being rapidly extended. Seventy-six per cent of Bell telephones employ dial operation for exchange service, and this achievement is being extended substantially.

Toll Calls Dialed

Thirty-three per cent of all toll calls today are dialed by the toll operator directly to the called telephone without intermediate assistance. While only fifteen per cent of all calls involving toll or other similar charges are now dialed directly by customers, requiring no toll operators at all, long-term plans provide for a great extension of this method of operation.

Private-line service is an important feature of telephone company services. Bell companies provide some 650,000 miles of private-line telephone circuits. They also employ 3,100,000 miles of private-line teletypewriter service. In some cases the private lines of one customer form a large network, with either automatic or manual switching. At present there are 28,400 teletypewriters receiving teletypewriter exchange service. This service uses about 2.6 million miles of telegraph circuit.

The telephone companies also provide extensive program transmission networks for radio broadcasting. Audio broadcasting uses 270,000 miles of specially designed circuits. Television transmission networks are developing rapidly and already extend approximately 17,600 miles. Video transmission requires very special facilities that occupy the transmission space required for 600 telephone transmissions.

The American Telephone and Telegraph Company offers telephone service to approximately ninety foreign countries. Any telephone in the United States can be connected to ninety per cent of all foreign telephones throughout the world. Telephone service to overseas points is handled by high-frequency radio circuits. American companies have approximately 115 such radio circuits, directly reaching 50 countries, and one low-frequency radio circuit to England.

Emergency Service

Bell companies are obliged repeatedly to meet emergencies caused by severe storms and other natural disasters. As a result, they have made extensive provision for minimizing interruptions of service and for the rapid restoration of service. They have had a great deal of experience in this important field.

Seven factors tend to minimize the crippling effects of emergencies. We will review them briefly.

1. The large amount and general dispersal of plant.—The New York City area, for example, is honeycombed with more than six million miles of trunk and toll cable. In addition, there are about eighteen million miles of subscriber cable radiating from the central offices. The destruction of telephone plant in any one locality would destroy telephone service only to that locality. If through circuits are interrupted, they can very rapidly be restored by rerouting through undamaged cables.

The same principle applies, on a much larger scale, to transcontinental intercity routes. The capacity of many of these routes is between one and five thousand long-distance telephone circuits. The design of intercity circuits is such that, if one route is interrupted, traffic can be carried around the break by alternative routes.

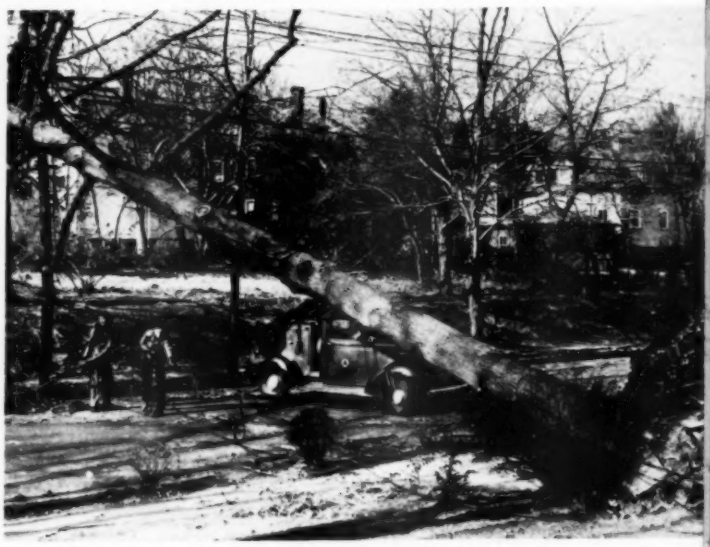
Toll Cables Immune

About 55,000 miles of transcontinental toll cable are relatively immune to interruption. Of the 220 cities that have service areas of 50,000 or more people, 90 per cent are connected with the cable network. New Orleans, the only city of more than 200,000 not now on a cable route, will be connected by cable to the network next year.

2. Large resources of men and materials which can rapidly be concentrated on a point of interruption.—Operating headquarters and major supply warehouses of Bell companies are strategically located across the country. Supervisory personnel at these headquarters points direct a force of 160,000 trained plant maintenance and construction men. Warehouses contain telephone materials and supplies valued at $140 million.

Whenever there is severe plant damage in a particular locality, due to storm or other reason, long-distance circuits can immediately be made good by rerouting. Plant men and materials from near-by areas, sometimes from half way across the continent, are immediately concentrated upon the affected spot to speed the restoration of service.

3. Standardization of materials and methods.—Basic to the ability to concentrate the resources of men and materials in the restoration of plant at a particular location is the standardization of plant and construction methods carried on by the Bell companies throughout the country.



The uprooted tree did not smash this New York telephone truck as it appears, but it did rip down important telephone lines which were quickly repaired.

4. Use of radio for emergency service.—Telephone companies throughout the Nation have radio available for use in an emergency. Radio is used particularly for short periods to provide emergency telephone service to small towns which are temporarily isolated from the toll network by the destruction of all the toll leads entering the town.

Radios in Trucks

The emergency radio includes about one hundred equipments operating in the 2-mc band and designed with sufficient power to be useful at distances up to fifty miles. These equipments are

mounted in trucks and are often dispatched to a point where a severe storm has been forecast—in advance of the actual damage.

14,200 Motor Vehicles

In addition to this, the Bell system provides service to about 14,200 motor vehicles associated with approximately 720 fixed stations throughout the country. About 1,000 of these mobile units are in telephone company cars. The others include many utilities, transportation companies, police, and other vital organizations. Thus many of these stations are already devoted to emergency work. All of these facilities are important in restoration work and could be used as needed by the agencies involved.

The Bell system also serves approximately 16,000 mobile radio stations on coastal ships and boats, operating through 26 fixed stations along the coast and connected directly into the entire Bell network. The system has about 150 microwave radio equipments of a type used for providing television pickup services. These could be converted to message service. Associated with these equipments are 12 portable aluminum towers, 140 feet high, designed for very rapid erection. Lower towers could quickly be built by using groups of telephone poles.

Emergency crews are always ready for winter ice storms which often tear down trees, severing communication lines.

If it should become desirable, some further protection to long-haul telephone service in time of disaster could be provided by diverting for domestic service many of the 115 overseas and high-seas radio channels located near New York, Miami, and San Francisco.

5. Emergency power arrangements.—Recognizing the importance of continuing telephone service under emergency conditions which may temporarily interrupt electric power service, telephone companies have made general provision for auxiliary power in the telephone offices. Approximately 4,000 engine-driven generator sets are now in service. During a recent windstorm in the eastern States, power was interrupted at 450 telephone offices. In none of these offices, however, was service affected because power was supplied by emergency power equipment.

Mobile radio units provide emergency service when communities are isolated.

6. War emergency stock.—The production of all types of telephone materials is at a high level. It is important that this high level of production continue—unless the national emergency deepens to a point where this becomes impracticable. In such an eventuality, the question of war-emergency stocks will be reviewed. Equipment purchases are now running at the rate of $750 million a year. With good stocks in warehouses, special emergency stocks do not seem to be necessary at this time.

Safety Precautions

7. Security of plant and service.—During World War II, special precautions were taken to prevent sabotage and espionage, such as the provision of special door locks, safety chains, electric alarm signals, and wire grilles on windows and skylights. Manholes and cable vaults were locked. Many telephones employees were required to give proof of citizenship, to use identification cards, and to be fingerprinted. All these procedures have been reviewed and are being reinstated when appropriate.

Having considered the seven factors that lessen the crippling effects of emergency situations, we will now devote some attention to current military and Government requirements.

With the stepping up of the defense effort during the past year, the telephone companies have been called upon to meet a large number of special communication requirements of the military forces and other Government departments. These requirements include extensive communication systems related to air-raid information and civilian defense.

Government requests, of course, naturally take precedence over other work. Very frequently, in order to meet the time element in a particular case, it is necessary to take existing circuits away from the telephone message service and later to replace them by building new plant. In many cases important new construction is involved.

Rapid Construction

An illustration taken from World War II, indicating what the telephone companies can do to meet special requirements, was the construction in one-fourth the normal time of an open-wire telephone line over 1,300 miles in length from Danby in Southern California along a route just east of the bastion of the Sierra Mountains to Yakima, Wash. This involved about 900 miles of new pole line, stringing 7,700 pair miles of wire, constructing 9 new buildings and 2 building additions, and installing carrier and repeater apparatus and other central office equipment.

The job was first proposed about April 1, 1942; the first phase of the construction work was completed on August 31st. Much of the route offered difficult working conditions. Construction camps were established in the desert. Six hundred and forty men were put on the job, including men bor-

rowed from five other Bell companies in various parts of the country.

Huge Investment

During World War II it is estimated that the telephone companies invested $150 million in plant built specifically to meet military and defense needs. It seems probable that, in the current defense effort, the amount of plant built for these needs will be greater. This figure does not include the plant necessary to take care of the added stimulation of general toll and exchange business produced by the intense industrial activity of the defense effort. The current estimate is that this stimulation requires the construction of added plant of several times the amount of that built directly for military uses.

Let us now take a quick look at the immediate material and manpower requirements of the telephone companies.

To take care of the telephone needs of the defense establishment, various Government agencies, and the requirements for defense production, and to a reasonable degree to meet the general telephone service requirements of the Nation, it is necessary for the telephone companies to continue to carry on a large construction program.

At the conclusion of World War II the telephone companies had a backlog of two million requests for service that had been held up because of a lack of facilities. Continuously since that time the companies have had high demands for additional telephone service. To take care of the backlog and to meet the demands for additional service, the telephone companies have carried on an extensive construction program. Five and a half billion dollars of telephone plant has been built since the war.

Service Increased

In addition, the companies have devised ways to increase the service provided by their present plant by cutting margins for growth far below those required to give service on demand, by increasing the use of party-line service in residences, and by other means. As a result, the backlog of held orders has been reduced to approximately 800,000 at the present time.

Telephone companies had expected to go far in clearing up the remaining held orders last year and had hoped to complete the job this year. However the upsurge of demand, which began with the Korean crisis last year, defeated this ambition. In 1951 the Bell companies plan to spend about $950 million for new construction. According to present indications, however, this will not bring about any reduction in the number of held orders. It will also be impossible to reduce the number of held requests for improved grades of service.

The growth of toll messages during

Skilled technicians keep the lines open.

and since the war has been even more rapid than the growth of exchange service—an increase since the end of 1940 of 170 per cent. This resulted in a great expansion and strengthening of the capacity of the toll plant. Yet the current increase in toll messages is at a rate far beyond that prevailing just before the Korean crisis and requires a further increase in the rate of building toll plant. This is particularly important for defense production which relies heavily on fast toll service.

Up to the present time the restrictions on materials imposed by the National Production Authority have had some effect, but not a great effect, in limiting the construction of the telephone companies. Some difficulty is being experienced in purchasing in full the amount of materials which the telephone companies are permitted to use, particularly the components which are purchased from thousands of other manufacturers.

Greater Need Today

The need of the telephone companies to continue to build substantial amounts of telephone plant in order to meet the communication requirements of the Nation is much greater today than it was during World War II. The telephone system is twice as large now as it was then and far more generally depended upon by every one.

The normal margins for growth, which could be drawn upon during World War II, and even at a later period, to take care of a great deal of the increased demand are absent from the present telephone plant. The plant is in many places overloaded. Generally speaking, new plant must be built equivalent to the amount of additional service to be given.

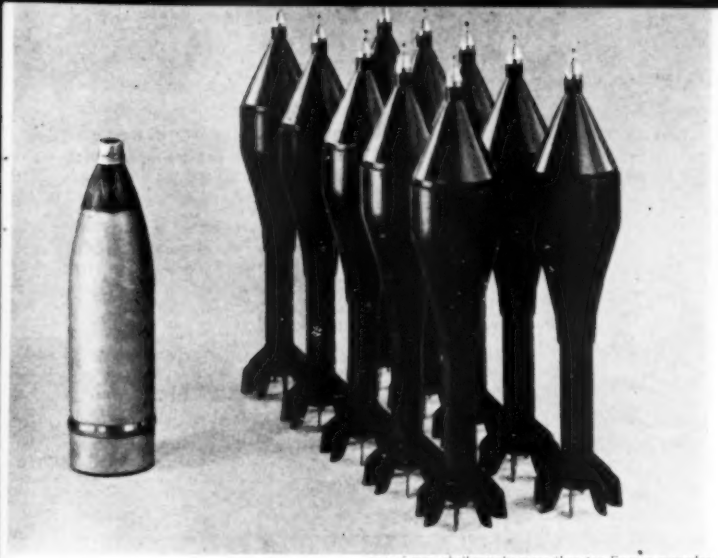
This brief survey of telecommunication problems should include a final word about current manpower difficulties.

During World War II, with a total force of 387,000 men and women (including the Bell Telephone Laboratories and the Western Electric Company), approximately 68,000 men and women went into military service.

616,000 Employees

Bell employees now total 616,000. Approximately 160,000 of this number are plant construction and maintenance men. The losses of plant forces to the armed services this year are expected to be approximately 9,000. To replace these and losses from all other causes, and at the same time to produce a desired net increase of 1,000 workers, would require gross additions of about 19,000 men.

The maintenance in such dangerous times as these of forces that are adequate in numbers, ability, and training is one of the important and difficult problems of telephone service.



One 75 mm. shell weighs more than ten Energa grenades

This new Belgian antitank weapon shows that the nations of Europe are capable of contributing their share to the arsenal of freedom-loving peoples

by

George Fielding Eliot

The Energa Antitank Grenade

WE have become accustomed to the idea that America is arming Western Europe—*period*. So it may come as something of a shock to find that in one case, at least, America is buying European weapons for our own use in Korea and elsewhere.

Purchased from Belgium

The case in point is the purchase of a considerable quantity of Belgium's Energa antitank rifle grenade, manufactured by the Société Anonyme Belge de Mécanique et d'Armement, a private corporation commonly known as Mecar.

The U. S. antitank grenade which was being issued in the spring of 1950 had for some time been recognized as obsolescent, due principally to its low armor penetration (only about two inches). The Army Ordnance Department was then at work on a new antitank grenade, which is far superior to the old one, probably superior in some respects to Energa. But this new grenade was not in mass production, so the Marines—when the Korean whistle blew—made exhaustive tests of Energa at Quantico; were pleased, even enthusiastic, over the results; and the U. S. Government bought a small quantity.

The Army was impressed by the results shown by the Marine Corps tests. The Korean war was not going too well; there were frequent instances when enemy armor was overrunning small American detachments; there was obvious need for an emergency antitank weapon for the front-line infantryman. The upshot was a contract by which Mecar was to furnish the Army with substantial quantities of Energa grenades and launchers. Contract negotiations were pushed through rapidly, as such things go, and were all settled by October 1950.

Situation Improved

But the Inchon landing on September 15th had by that time completely altered the character of the Korean war. Enemy armor had been pretty well eliminated. It was no longer a question of U. S. infantry holding enormously extended fronts with inadequate air and artillery support. Better training in the use of infantry weapons—notably the bazooka—and the arrival of additional weapons and ammunition had contributed to a much more favorable tactical situation—specifically to the almost total disappearance of hostile armor from the Korean battlefield.

In consequence, only a small number of the Energa antitank grenades were actually shipped to Korea. The bulk of those delivered under the U. S. contract seem likely to form a useful reserve of antitank weapons until such time as the new U. S. antitank grenade can go into quantity production.

Example of Mutual Aid

This may seem somewhat of an anticlimax to our story. But it is as an example of mutual aid in arms production, rather than as a dramatic instance of little Belgium saving the day when Uncle Sam was on the skids, that the story has its real value. Furthermore, by making this purchase, which required an increase in capacity of the Belgian factories, the United States Government has contributed in a very real sense to

Major Eliot is an internationally known author and journalist. He is military and naval correspondent for the *New York Herald Tribune*, military analyst for the Columbia Broadcasting System, and has written such books as "The Ramparts We Watch," "The Strength We Need," and "Hate, Hope, and High Explosives."

the increase in the manufacturing capacity of the Allied European arms industry.

The antitank rifle grenade is a minor item of armament in any case. When a tank gets close enough to be hit with a rifle grenade, the infantryman is already in trouble. To a harassed squad leader suddenly beset by enemy armor when the bazooka team isn't at hand or has been knocked out and when he doesn't have time to call for air or artillery support, a good antitank grenade may prove a godsend.

Occurred too Often

But this is a situation which doesn't (or shouldn't) occur too frequently, though it did occur all *too* frequently during the early days of the Korean fighting simply because our combat elements were mere skeletons of what they should have been. Antitank grenades also have their obvious value to outposts and patrols, but they remain emergency weapons—things you use when you don't have something better handy.

The fact that the sudden outbreak of hostilities in Korea caught the U. S. without a satisfactory antitank grenade doesn't demand any great emphasis, either. These things will always happen when operating on limited budgets. In assigning budget priorities, the tendency is always to "make do" for another year with the old model of anything that isn't absolutely vital, to spend the money for the things that really count.

It was just a lucky break to find that a private firm in an Allied country, conducting its own research and development and producing weapons with the much-deprecated but ever-present motive of selling them for a profit, had something ready to produce which we could use to fill in the gap.

Allied Arms Industry

It is the fact that there does exist an arms industry in Allied countries which is capable of producing weapons that can meet the exacting specifications of our own services that has the real claim on our attention.

According to the published statements of the manufacturers, the Energa grenade is capable of piercing 200 millimeters of armor of a hardness close to 240 Brinell. It is a shaped-charge weapon, weighing approximately 1½ pounds, and has proved effective at ranges of from 75 to 100 meters.

The manufacturers state that against a stationary target satisfactory results have been obtained by trained grenadiers at ranges up to 125 meters. Technical data obtained by our own Marine and Army tests are still on the classified list, but it may be added that the Energa grenade is also being purchased in quantity by the British Army and is meeting expectations in that service.

The grenade has a rigid monoblock tail unit, improved in more recent models to give a high degree of accuracy. In manufacturer's tests, a group of 10 hits in an area of 40 by 40 centimeters at 75 meters' range is not unusual. The maker's claim of a high degree of consistency is borne out by tests conducted in this country. There seems to be very little variation from lot to lot, or of rounds in any tested lot, which in the long run helps to give the soldier confidence that his weapon won't fail him when he needs it most.

And, it may be added, of all weapons in which such confidence is needed, the antitank grenade ranks very high, for when it comes to using one against enemy armor it is just as well to knock out the tank on the first try—there isn't likely to be any opportunity for leisurely adjustment of fire.

Built-in Safety

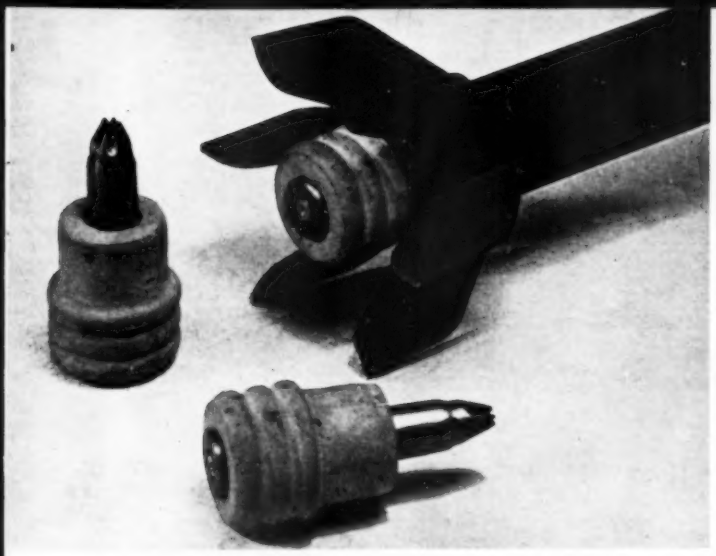
The Energa grenade has a nose fuze with a built-in safety. A hard rubber cap is provided as an additional safety device. If the firer forgets to remove this cap before firing, the grenade will still function. (How often does this ex-doughboy remember the feeling of sad futility which comes to the fellow who throws a Mills grenade but forgets to pull out the safety pin first!)

An interesting gadget is a paraffin-coated cork in the orifice in the tail assembly. This cork contains the propelling cartridge. The procedure on firing is to remove the cork, place the grenade over the launcher, and the soldier then has the propelling cartridge right in his hand ready to load into his rifle and doesn't have to fumble around for it.

Ingenious Weapon

All in all, the Energa grenade is a serviceable and ingenious weapon. As an example of what our Allies can do in the way of producing arms, it is of considerable significance.

Carrying case and launcher, showing removable sighting grid.



Paraffin-coated cork protects tail orifice and holds propelling cartridge.

For, in the last analysis, we cannot rearm Europe. American weapons in the hands of European troops are necessary today while European arms production is being built up—but they are only a stopgap. What we are doing is to provide weapons for a covering force of minimum strength, behind which the real rearmament of Europe is taking form. The United States may in many respects have been the arsenal of democracy in the last war, as it is likely to be in any war of the immediate future. But it is upon the ability of our European allies to rearm themselves, at least defensively, that their security will rest in the long run. The U. S. purchase of the Energa grenade contributes to that ability.

Other Evidence

I saw a good deal of other evidence along this line during a month's visit to Allied military establishments this spring. The French, for one example, have turned out a quite remarkable 105-mm. howitzer at their Bourges arsenal, are manufacturing a semiautomatic rifle which is being adapted to U. S. caliber .30 ammunition, and are going into limited production on a light tank (thirteen tons), an armored car, and a bazooka.

The Belgians are also producing a semiautomatic caliber .30 rifle. Italy, restrained by peace-treaty limitations, has considerable arms-producing capacity.

The French Minister of National Defense, M. Jules Moch, told me proudly that of the five new infantry divisions which France is creating this year and which will be transferred to General Eisenhower's command (according to current plans) by January 1, 1952, one will be fully armed with new French weapons.

To some extent this involves uneconomical methods of production—such as manufacturing a mere 1,000 of the 13-ton tank at the Issy-les-Moulineaux arsenal with no further mass production in prospect—but it is the example, the spur to national pride, the rising feeling of self-reliance which seems important to this reporter.

For from these seeds may well grow that greater confidence in the ability of free peoples to defend themselves which must be the final test by which, in the end, the North Atlantic Alliance will stand or fall.

Ultimately a secure Europe must be a Europe capable of meeting the initial shock of barbarian attack with its own resources. The building up of those resources, their organization into a self-reliant system of mutual aid and confident coöperation, is one of the major tasks that lie before the statesman and the soldier of the free world.

There is some danger today that the emergency aspect of the problem may overshadow the need for giving due consideration to the long-range needs of European security and the place which such a Europe might occupy in the fabric of world-wide defense, of which the United States is the leader and the principal champion, but which we cannot wholly arm with our own resources.

Seek Strategic Freedom

It should be clear that we should seek to regain strategic freedom of action for ourselves, to free ourselves as far as possible from localized defensive needs on fixed fronts, and regain mobility for the types of striking power which we are more capable of producing than any of our Allies can hope to be for many years to come.

Today all this is somewhat obscured in our thinking by the necessity for contributing directly to the defense of allies whom we cannot think of abandoning. We are drawn into arguments of the "either-or" type—into discussions of which is the decisive weapon—the B-36 or the doughboy on the ground—and that sort of futility. We take pride in living up to our commitments without always thinking through the nature and the end purpose of those commitments. For example, we think of putting six U. S. divisions in Europe as an end in itself rather than as a modest contribution to a covering force behind which Europe can really rearm.

Good Example

All this has of course been reasoned out before in great detail. But words are one thing, a concrete example is quite another. If the use by our own troops of a Belgian grenade in an emergency can make us realize that Europe can one day produce weapons of all sorts sufficient to its defensive needs, and that this is the ultimate purpose of our temporary contribution to present European defense, the little Energa grenade will have served a far greater purpose than merely the filling of a minor gap in our own production schedule to meet a sudden need.

Jet-Powered Assault Transport

Shown above taking off on its first flight is the XC-123A Chase assault transport, jet-propelled version of the XC-123 developed from the Chase CG-20 all-metal cargo glider. The new version, shown below in full flight, is powered by four General Electric J-47 turbojets rated at 5,200 pounds' thrust each and can take off on short runways (Air Force photos).

THE THIRTY-THIRD ANNUAL MEETING

of the

American Ordnance Association

will be held under the auspices of

THE CINCINNATI POST OF THE ASSOCIATION

at the

Netherland-Plaza Hotel, Cincinnati, Ohio

Thursday, October 4, 1951

And upon invitation by the

SECRETARY OF THE UNITED STATES AIR FORCE

at

Wright-Patterson Air Force Base

Friday, October 5, 1951

Complete details of the two-day meeting, including programs of the seminars, plant visits, and dinner meeting at Cincinnati, and also the tests and demonstrations at Wright-Patterson Air Force Base, will be mailed to all members of the Association on September 1, 1951. Topics of timely interest and unusual significance to the national defense, especially from the viewpoint of aircraft armament, will be considered.

Members of the American Ordnance Association are urged to reserve these dates: Thursday, October 4, 1951, at Cincinnati and Friday, October 5, 1951, at Wright-Patterson Air Force Base, Dayton, Ohio.

Month by Month: High Lights of the National Defense

Atomic Horizons

In a recent address at the "Radioisotopes in Industry" Conference at the Case Institute of Technology in Cleveland, Commissioner T. Keith Glennan of the U. S. Atomic Energy Commission observed that isotopes for scientific, medical, agricultural, and industrial use constitute by far the most important contribution of the development of atomic energy to peacetime welfare. As evidence of the progress that has been made, he cited some rather significant figures.

> *In 1947, 241 departments in 160 institutions were using isotopes. Two years later, in August 1949, there were 549 departments in 305 institutions using isotopes. In December 1950, AEC-supplied isotopes were in use in 939 departments of 485 institutions in 47 States and territories of the United States and 175 institutions in 29 nations abroad.*

So impressive has been recent progress in the isotope field that Commissioner Glennan feels that we have reached the point where we might properly examine a few of the obvious things that are needed if the participation of private enterprise is to continue to increase to the point where it might some day expect to take over a substantial share of the isotope program from government.

By raising these points he did not mean that something necessarily had to be done about them now but that all of us should begin to think about them. He listed the following:

1. The obvious need for vastly greater numbers of people trained in the techniques of handling and using isotopes.

2. A considered awareness by industry of the health and safety factors involved in the large-scale use of radioactive materials.

3. Careful consideration and advanced planning by industry in regard to the many economic factors involved.

4. An intensive study by industry of all of the possible uses for isotopes, in process control, production, testing, and research.

"It is my personal belief," Commissioner Glennan said, "that the maximum potentialities of isotopes have not yet even begun to be realized, and considerable research must be accomplished before we can make any safe predictions. The Atomic Energy Commission is now sponsoring a research study by the Stanford Research Corporation into the possible uses by industry of fission products. This is a step in the right direction, but it will take many such steps, with industry not merely coöperating but actually taking the leadership, before the maximum possibilities of isotopes are known."

Manpower

Just prior to his selection as Commanding General, Second Army, a post vacated by Lieut. Gen. James A. Van Fleet when he was ordered to duty in Korea, Lieut. Gen. Edward H. Brooks, the Army's personnel director, made a highly valuable observation on the full utilization of all our manpower resources. General Brooks spoke before a meeting of the Philadelphia Post of the American Ordnance Association at Valley Forge Military Academy, May 24, 1951.

> *"With rare exceptions," General Brooks said, "every one is capable of doing something regardless of his handicap. In visualizing a total war, we must begin to think in terms of using people, both in industry and in the armed forces, on the basis of what they can do rather than rejecting them on the basis of what they can't do. These less physically able segments of manpower must be utilized fully and equitably by all agencies involved in the defense effort."*

The Department of Defense is also concerned with the proper utilization of our manpower potential and has recently announced approved new policies relating to the Reserve forces.

"The establishment and maintenance of an effective and dynamic reserve force," Defense Secretary George C. Marshall said, "will be accomplished only by the full acceptance of responsibilities by all concerned. The military departments must provide appropriate plans and programs. The Reservist must exercise his right and meet his obligation to participate actively in those programs. Necessary support must be made available by the Congress, and the interest, approval, and coöperation of the public is a prime prerequisite to success."

> *The new plan calls for an Assistant Secretary in each military department. In addition to his other duties he will have primary responsibility for Reserve matters. Representation will exist at secretarial level for all the Reserve forces in each military department.*

The respective military departments will establish an office directly responsible to the Chief of Staff of the Army, the Chief of Staff of the Air Force, the Chief of Naval Operations, and the Commandant of the Marine Corps, as appropriate, for Reserve forces. This office will serve as a focal point for the supervision of Reserve programs and as expediter for insuring completed staff action relative to Reserve problems.

Our only fear is that the proposed organization will be just more weight to be added on to the gigantic behemoth our military establishment headquarters have grown to be.

Despite the advantages of unification certainly one of its greatest disadvantages—if not the greatest—is in unconscionable pyramiding of overhead and the resultant added red tape. It is to be hoped that the proposed Reserve operations will cut the present staff overhead by at least fifty per cent!

Defense Procurement Totals

March military procurement totaled $4.4 billion. For the first nine months of the 1951 fiscal year the Defense Department summarized its obligations for procurement and construction as follows:

Combat equipment (aircraft, ships, tanks, weapons, and ammunition), $19.2 billion.

Clothing, subsistence, and petroleum products, $3.1 billion.

Military construction and facilities expansion, $1.8 billion.

The total is $24.1 billion.

By services, the breakdown is as follows: Army $9.9 billion; Navy $5.4 billion; and Air Force $8.8 billion. Included in this total of $24.1 billion is procurement by the military departments for the Mutual Defense Assistance Program of over $2 billion.

As of the end of March, approximately $28.8 billion were available to the armed services for further procurement during the remaining three months of the current fiscal year.

Procurement demands can only be met if our industrial reserve capacity is utilized.

Of the 185 facilities held in the National Industrial Reserve on April 1st, only 32 plants were idle. Eighteen plants were producing items other than those scheduled in the mobilization plan, nineteen plants were producing items similar to those designated in the mobilization assignment, eighty-six plants were actually producing items for which they are scheduled, and twenty-seven plants were in the process of being reactivated to produce such items.

Weapons Systems Engineering

The Air Force has announced that it will again emphasize courses in weapons systems engineering at the Massachusetts Institute of Technology during the coming year.

The 2-year curriculum will stress basic principles of mathematics and physics, followed by aëronautical and electrical engineering subjects. Final semesters will include applied problems related to Air Force research and development projects currently being carried on by the staff of the Instrumentation Laboratory at M.I.T.

Brig. Gen. Leighton I. Davis, Commandant of the Air Force's Institute of Technology, stated that "the Air Force need for officers well grounded in all phases of automatic sighting, aiming, and firing equipment is on the increase."

He explained that the term "weapons systems engineering" is used to cover the art of marrying many devices and techniques: physics, mathematics, electrical, mechanical, and aëronautical engineering, and others.

"This marriage," he said, "is necessary for the efficient use of such ordnance items as guns, bombs, and rockets on the airpower team."

With aircraft in battle at speeds in the 600 mile-an-hour range, time itself becomes the paramount factor in air war. In any successful airborne weapons system the emphasis must be on speed —speedy and automatic measurement of ranges and velocities and angles, then precise aiming and timing.

"This accent on speed has taken the terrific aiming and sighting problem out of human hands and given it to automatic control devices," General Davis said.

"In time intervals measured in split seconds, radar must detect and follow, computers must make swift and accurate calculations, and finally the aircraft controls must react precisely as the computer directs, if targets are to be hit."

The highly complicated and scientific nature of such equipment will continue to call for highly developed technical intelligence in its administration. Squadrons whose aircraft bear automatic weapons systems must have specialists on their staffs. Research, development, and engineering activities will know a continuing requirement for officers educated in the weapons systems engineering fields.

Aid for Small Business

The Munitions Board has adopted new procurement policies and expanded existing policies in order to provide maximum aid for American small business to participate in the industrial mobilization program and to expand the Nation's industrial base of suppliers.

Outstanding in the program, as announced by John D. Small, Munitions Board Chairman, are:

1. A directive that assigns small business specialists to each armed service procurement office throughout the country.

2. Affirmation of a policy calling for the maximum use of the Nation's industrial capacities already available, with limited use of "certificates of necessity" for those cases where open industrial capacity is not available.

3. Agreement upon the payments of justifiable price differential in negotiated procurements to accomplish the objectives of broadening the industrial base of suppliers.

4. A fixed program of encouragement of subcontracting.

5. A provision to divide many negotiated procurements into small lots to allow multiple awards.

In addition, the Munitions Board asked for a review of the armed services production allocation programs with a view toward increasing the number of sources and the variety of classifications of industry from which supplies may be secured.

In asking that subcontracting be greatly encouraged, it directed that each important negotiated purchase be carefully examined to determine the extent to which subcontracting could be encouraged or even required. The extent of such subcontracting will be considered as one of the factors in the negotiating and pricing of the prime contracts.

In directing that small business specialists be assigned in each armed service procurement office, the Board said that these specialists will devote all of their efforts toward bringing small business concerns into the military production programs. They will recommend portions of defense production which can be produced by small plants in each region. They will also maintain liaison with other Government agencies on behalf of small business.

The Defense Production Administration has published a small booklet entitled "Mobilization Guide for Small Business" to help small and medium-size firms make a maximum contribution in meeting defense needs and maintaining the highest possible output of consumer goods.

Gages for Ordnance Production

The American Ordnance Association has published the proceedings of the annual meeting of its Gage Industry Division, held earlier this year at the Naval Gun Factory in Washington, D. C. The following papers were presented by civilian and military experts:

Brig. Gen. Burton O. Lewis: "Gage Industry Survey."

Col. W. J. Darmody: "The 1951 Ordnance Gage Production Program."

Col. J. C. Schneider: "Air Force Quality Control and the Gage Industry."

Capt. W. L. Tann, U.S.N.R.: "Naval Ordnance Planning for Inspection Gages."

M. E. Steczynski: "Ramp Gages for Taper Pipe Threads."

D. R. Miller: "Thread Gages."

S. B. Terry: "Coördination of Military Inspection Policies and Procedures."

Copies of this brochure are available upon request to the American Ordnance Association.

Expansion of Logistics

A recent release from one of the subterranean public information caverns in The Pentagon was startling.

Some anonymous journalist invites our attention to his one-man revision of the time-honored definition of logistics:

> *"Because of the great losses in material which we suffered during World War II," says this scribe, "we have had to revise our definition of logistics as 'the art of delivering the right thing at the right place at the right time' to include 'in usable condition'."*

It is certainly odd that nobody ever thought of this before!

Old-style logistics may have wantonly embraced the shipment of both serviceable and defective howitzers, mellow and rancid prunes, good ammunition and duds.

Or maybe these items started out well enough but became sour or bent or mildewed somewhere in the logistical pipeline.

In either case it is difficult to understand how delivery could be made of the "right thing" that was, at the same time, the wrong thing—like a bent howitzer or Coca-Cola without straws.

> *Much as we regret to say so, fidelity to our college course in Logic II compels us to observe that the notion of "in usable condition" is implicitly contained in the term "right thing" employed in the classic definition of logistics.*

Eighteen hundred words later, our Pentagon philosopher concludes his release with the following gem:

"Whether the item is a minute industrial diamond for a wheel-dressing tool or a D8 tractor; whether it is a fragile incandescent light bulb or a practically indestructible object like an anvil, our packaging department will wrap it up safely for a trip to the next town or to the North Pole and guarantee its arrival in good condition."

We have deposited this particular release in our "Gee Whiz Golly" file. It is comforting to know that if we want to send an anvil to the North Pole it will be packaged properly.

Ordnance Training Courses

Unique among Army educational facilities is the comprehensive college-level course in automotive mechanics now being conducted for a large group twice each week at the Mannheim Ordnance Depot in Germany.

The course is an adaptation of the curricula presently being followed by automotive engineering students in college-level technical and engineering schools in the United States.

> *Instruction covers a 6-month period and is carried on in the following five phases: engine theory, fuel, lubrication and cooling systems, automotive electricity, transmissions and differentials, and chassis design and construction.*

Another fine record is being achieved by Ordnance troops in the Koshien Ordnance Depot in Japan. The function of this depot is the rebuilding of wrecked or damaged Army vehicles from all parts of the Far East Command.

Since the outbreak of the Korean war the depot has turned out more than 4,000 restored vehicles for shipment.

Strategic Air Power

The Department of the Air Force is distributing the black-and-white public information film "Strategic Air Power." This 25-minute motion picture is cleared for all public nonprofit theatrical and television screenings.

"Strategic Air Power" is a dramatic documentary presenting the mission of the Strategic Air Command and explaining the rôle played by men and planes in carrying out that mission. The film may be borrowed from any Air Force Film Library.

Psychological Warfare

Psychological warfare waged by the Army has brought about the surrender of nearly a third of the 200,000 Chinese Communist and North Korean troops who have been taken prisoner so far in the Korean conflict.

The Department of the Army reported that, by their own admission, some thirty per cent of the enemy captured have been convinced by leaflets, radio, and loudspeaker broadcasts that their cause is lost or that they have been fighting for the wrong cause.

> *Such prisoners emphasize that vigilant surveillance by their superiors made capitulation difficult, and that their numbers would be swelled if troops of the Chinese Communist and North Korean armies could escape such vigilance long enough to surrender.*

Brig. Gen. Robert A. McClure, Chief of Psychological Warfare, Department of the Army, made it clear that such operations are supplemental to the main battlefield effort. He said:

"No one believes that psychological warfare will win any battles single-handed. We make no such claim for it. Properly handled, however, it can aid in the winning of a given battle and speed the eventual victory."

MacArthur on Industrial Mobilization

An Editorial

IN recent weeks all phases of the life and work of General Douglas MacArthur have been subjected to the white light of public analysis. Extending over a lengthy period of our country's development, during which the two greatest wars in all history were fought, it is a truism to say that General MacArthur's philosophy has had a profound and most beneficial bearing on our military policy of the past thirty years.

But there is one particular phase of his vast influence which, during the debates now current, has not been given its proper recognition. We refer to his unceasing advocacy of the preparation, in time of peace, of plans for industrial mobilization in time of war. This is the goal to which the efforts of the American Ordnance Association have been directed throughout the three decades of General MacArthur's leadership. This is the field in which he has played a vital rôle. The record is plain for all to see.

For the first time in the history of the United States a comprehensive industrial-mobilization plan was presented to the Congress in mid-1930. The presentation was made by General MacArthur in person before the War Policies Commission—a group composed of the heads of the executive departments of the Government and of members of the United States Senate and House of Representatives. The function of the Commission was to study the measures necessary to insure an efficient defense system and to take the profit out of war. General MacArthur, in conjunction with the then Assistant Secretary of War, Frederick H. Payne (now a director of the American Ordnance Association), took the mobilization plan to the Congress and presented it to the Commission in detail. The MacArthur plan represented the best thinking of the defense authorities and had the collaboration of outstanding industrial, financial, and military leaders of the time.

The Mobilization Plan of 1931

On the basis of the MacArthur presentation the War Department Mobilization Plan of 1931 became the "bible" on which all further industrial-mobilization planning of succeeding years was based. The plan was revised periodically between 1931 and 1939 and was ready for immediate application when World War II became imminent. Sad to relate, the plan was put into use only after long delay. That is another story. But the development of the plan and General MacArthur's presentation in 1931 were major steps in our industrial-mobilization progress.

Indeed, so enthusiastic were students of industrial preparedness in those days about the achievement in presenting our first industrial-mobilization plan, that on all sides there were high hopes for the saving of time and life and wealth should there be another major war in which the United States became involved. Witness the following editorial comment in this magazine in its November 1933 issue:

General Douglas MacArthur during his incumbency as Chief of Staff of the Army has done such a magnificent piece of work for the military establishment that we take this opportunity, coincident with the completion of three years of his service in that high office, to join with all other friends of national defense in congratulations to him and to the Army. Every one who has observed the skillful and untiring way he has carried the many burdens with which the Army has been faced since the very day he assumed his office is familiar with the magnitude of the problems he has coped with. The harder the task, it seems, the greater leaven of common sense and perseverance he gives it.

The problems of the last three years have been gigantic ones for the Army as they have been for every other organization and individual without exception. Upon General MacArthur's shoulders have fallen many of the burdens of the day and the heats, and he has emerged from them with colors flying. To the momentous questions of the present and those yet to come he may be depended upon to stick to his guns. The Army is indeed fortunate in having a man of his knowledge, experience, and zeal as its military guide and adviser to the civilian heads.

In recalling some of the things for which the Chief of Staff can take to himself a goodly measure of well-merited congratulation, students of military affairs will not overlook several milestones in the peacetime advancement of the Army. Notable among these are the studies begun with General MacArthur's presentation of recommendations to the War Policies Commission in 1930 which have finally emerged in the Mobilization Plan, 1933, as approved by the Secretaries of War and Navy.

Against great odds, it was General MacArthur who saved the cadre of officer strength when Congressional opponents were bent upon crucifying the National Defense Act of 1920. Add to these the sound tactical principles that have become Army policies during the past three years and the success thus far of the program for rehabilitating the Army with Public Works funds and we have ample evidence of the soundness of the MacArthur doctrines. He has given more than his share of tremendously valuable leadership. We salute him and the Army whose good fortune it is to have him as its military head.

As a result of the above comment, the editor of this magazine received the following letter, dated December 26, 1933:

"I have just read, in the November-December issue of ARMY ORDNANCE, your very flattering review of my three years' work as Chief of Staff. To express the full measure of my appreciation for the generosity and warmth of your editorial is quite beyond me.

"Possibly more than any one else, I am sensible of the extent to which you have accorded me undeserved credit for important accomplishments. Solutions to national-defense problems are not evolved or made effective without the earnest and able coöperation of thousands of individuals, both in governmental service and in civilian life.

"In the struggle to improve and sustain efficiency in the military establishment the assistance of the Army Ordnance Association has been of inestimable value, not only because of the character and ability of its individual members, but because of the courageous and unyielding stand the Association has invariably taken on every critical question.

"In the unstinted language of your commendation of my own efforts I feel that you are reaffirming the belief of your Association in the need for an adequate defense establishment and your determination to support every legitimate effort toward satisfaction of this need. For this reason, as well as for the more personal one, your editorial is particularly gratifying to me.—DOUGLAS MACARTHUR, *General, Chief of Staff, United States Army.*"

ASSOCIATION AFFAIRS

• **AT WASHINGTON.**—The Washington Post of the American Ordnance Association joined with the local chapters of similar patriotic organizations in sponsoring the highly successful 1951 Industry-Armed Forces Conference at the Mayflower Hotel on May 15th.

The primary purpose of the conference was to give executive Government personnel, now drafting plans which will be of vital interest to industry, an opportunity to discuss their programs, plans, and objectives with key industrial representatives and explain how industry can best assist in building a stronger national defense.

The morning session was devoted to talks by Charles E. Wilson, Director of the Office of Defense Mobilization; Manly Fleischmann, Administrator of the National Production Authority; and Eric Johnson, Administrator of the Economic Stabilization Agency.

During the afternoon session the speakers were John D. Small, Chairman of the Munitions Board; Archibald S. Alexander, Under Secretary of the Army; Chester D. Seftenberg, Deputy Assistant Secretary of the Air Force; John T. Koehler, Assistant Secretary of the Navy; and Frank Roberts, Chairman of the Military Renegotiation Policy and Review Board.

The speaker at the dinner meeting was Gen. J. Lawton Collins, Chief of Staff of the Army, who expressed his belief that, for the first time in our history, our military build-up is undergoing an orderly mobilization.

"By proper time-phasing of our call-up of men and our production of equipment," he said, "we feel that industry will have the greatest stability in manpower when it is most essential—during conversion and initiation of defense production.

"In addition, the lead time of many items of equipment will still give us ample time, in the event that we are forced into a general mobilization, to call these men into the active military service and train them by the time their equipment comes rolling from the production lines. Thus industry, science, and the armed forces are working in splendid unison to accomplish a properly phased and integrated mobilization for defense."

Members of the executive committee for the conference included Maj. Gen. John K. Christmas and J. Donald Browne of the American Ordnance Association.

• **AT LOS ANGELES.**—The Los Angeles Post observed Armed Forces Day, May 19th, by visiting the Torrance plant of the National Supply Company.

The plant tour provided an opportunity to observe the making of equipment for the armed forces, including ordnance material for the Army, ship shafting for the Navy, and B-36 bomber components for the Air Force, in addition to oil-field drilling machinery and other products, many related to defense requirements for various western industries.

The program was arranged by J. D. Spalding, works manager of the Torrance plant and president of the Los Angeles Post.

Following a barbecue luncheon, brief talks were given by Col. W. S. Broberg, Ordnance District Chief; Lieut. Comdr. Walter H. Eschmann, Office of Inspector of Naval Material; and Maj. Harry N. Bailey, regional representative of the Western Air Procurement District. Col. A. R. Baird, formerly in charge of the Los Angeles Ordnance District, was also introduced to Post members.

Ten days later, on May 29th, Post members made an all-day tour of the Naval Ordnance Test Station at Inyokern, China Lake, Calif. The group was welcomed by Capt. W. V. R. Vieweg, commanding officer at the station. The reply was made by Thomas T. Arden, executive vice-president of Grayson Controls Division, Robertshaw-Fulton Controls Company.

The nominating committee offered the following names for membership consideration in the election of Post directors: For terms ending December 31, 1952: Henry L. Clark, General Motors Corporation; R. C. Geffs, Clary Multiplier Corporation; C. H. Nazro, Byron Jackson Company; Morris B. Pendleton, Plomb Tool Company; and Mr. Spalding, National Supply Company.

For terms ending December 31, 1953: F. W. Conant, Douglas Aircraft Company; Dr. Louis G. Dunn, California Institute of Technology; P. W. Lizza, Bermite Powder Company; J. P. McCafferty; and W. A. Wilson, Web Wilson Oil Tools, Inc.

For terms ending December 31, 1954: Walter C. Main, Technical Oil Tool Corporation; K. T. Norris, Norris Stamping & Manufacturing Company; John B. Rauen, U. S. Spring & Bumper Company; S. K. Rindge; and C. B. Tibbetts, Los Angeles Steel Casting Company.

The new board was scheduled to meet June 18th for the election of officers.

• **AT ALBANY.**—The Capital Cities Post elected new officers at its first annual meeting since receiving its charter. Harry L. Erlicher, vice-president of General Electric Company, was elected president of the Post at the May 16th meeting, succeeding Hiland G. Batcheller of the Allegheny Ludlum Steel Corporation.

Other officers elected were Ledyard Cogswell, Jr., president of the Albany Lumber & Planing Mill Company; and Sanford Cluett, vice-president of Cluett Peabody & Company—vice-presidents. E. S. Webster of Watervliet Arsenal was re-elected secretary-treasurer.

Directors elected for 3-year terms were Col. Harry N. Rising, Colonel Cogswell, Ernest E. Johnson, and Leon W. Dwyer.

Following these elections, W. S. Skuce, Assistant Administrator for Production Controls, National Production Authority, spoke on NPA's materials-control plan by which vital raw materials are allotted to industry to spur defense production without upsetting essential civilian industry. Mr. Skuce said the Nation is attempting a dual economic program, maintaining a balance between peacetime production and preparedness for possible war.

Mr. Webster reported that the Post now has 5 company members and 401 individual memberships.

The Post is coöperating with John O. Amstuz, executive vice-president of the Behr-Manning Company of Troy, N. Y., in applying a new plan of inventorying "the human factor" in small plant management.

The Capital Cities Post committee work is now providing even the smallest industrial manufacturer with an opportunity to become an important cog in the over-all defense production organization. Coöperative steps aiding small industry include technical advice, reports of available contracts and reports to the Federal Government about regional facilities. The procedures provide a mutual-

aid program for industry and Government, based on industry's own activities.

• **AT HOUSTON.**—The Texas Post held its annual meeting for the election of officers at the Officers' Club, Ellington Air Force Base, Houston, Tex., on April 20th.

The newly elected officers are E. D. Konken (Napko Paint & Varnish Company), president; W. O. Hedrick (McEvoy Company), vice-president; and Leo S. Bassett (Dickson Gun Plant), secretary-treasurer.

Col. D. J. Martin (Hughes Tool Company), former president of the Post, was elected to the board of directors. Other members are L. B. Ryan (Rice Institute), W. H. Miner (Lufkin Foundry & Machine Company), H. H. Brien (Texas Foundries), O. L. Lorchn (Cameron Iron Works), and H. J. Hagn (Well Equipment Manufacturing Corporation).

Officials of the Post on the national Association roster are B. T. McNeil (McEvoy Company), Advisory Board; Ross Stewart (C. J. Stewart & Stevenson), Council; and Colonel Martin, vice-president.

• **AT PHILADELPHIA.**—The twenty-fourth annual meeting of the Philadelphia Post was held on May 24th at the Valley Forge Military Academy. The day's activities included the showing of training films in military science and tactics, formal guard mounting by the cadets on the Main Parade, a garrison review, dinner, and a cadet band and glee-club concert.

Distinguished guests included Brig. D. R. Agnew, Royal Canadian Army; Dr. Henry B. Allen; Lieut. Gen. Edward H. Brooks; Maj. Gen. Milton G. Baker; Edward G. Budd, Jr.; Brig. Gen. Hugh B. Hester; Capt. John Howell, U.S.N.; Capt. Harry Ingram, U.S.N.; Mrs. Clifford Jones; Arthur C. Kaufmann; John McShain; William J. Meinel; Lieut. Col. Howard E. Norris; Howard C. Peterson; James L. Walsh; and Maj. Gen. Frank A. Weber.

Maj. Gen. G. M. Barnes, retiring president of the Post, presided at the installation of new officers and directors.

The new officers are D. N. Hauseman, president of the Houdry Process Corporation, president; Robert T. Gebler, secretary-treasurer; and Donald Armstrong (U. S. Pipe & Foundry Company), Albert W. Gilmer (Barnes, Dechert, Price, Myers & Clark), Howard S. Lewis (Parish Pressed Steel Company), and William H. Worrilow (Lebanon Steel Foundry), vice-presidents.

Directors whose terms of office expire in 1952 are the former Post president, General Barnes (Budd Manufacturing Company), Edward G. Budd, Jr. (Budd Manufacturing Company), Henry W. Gadsden (Sharp & Dohme), H. Paul Gant, Mr. Gilmer, General Hauseman, George P. Luckey (Hamilton Watch Company), Mr. Meinel (Heintz Manufacturing Company), J. T. Simpson (Harrisburg Steel Company), and C. Jared Ingersoll (Muskogee Company).

Directors whose terms of office expire in 1953 are: Thomas A. Kennally (Philco Manufacturing Company), E. J. Langham (Sun Oil Company), Henry Marsh (Hercules Powder Company), Howard C. Peterson (Fidelity-Philadelphia Trust Company), Arthur J. Seiler (Main Belting Company), Marvin W. Smith (Baldwin Locomotive Works), Everett B. Webster (Crown Can Company), Henry H. Ziesing (Midvale Company), Charles S. Redding (Leeds & Northrup Company), and Martin Sandler.

Greetings to Post members and distinguished guests were extended by Colonel Walsh, president of the American Ordnance Association.

The speakers on this important occasion were General Baker, superintendent of the Valley Forge Military Academy, who spoke on the North Atlantic Treaty; and General Brooks, War Department General Staff, who discussed the problem of manpower in the present emergency.

The John C. Jones Medal awarded annually by the Philadelphia Post was presented this year jointly to Dr. William J. Kroeger and C. Walton Musser, Ordnance engineers on the staff of the Frankford Arsenal. They are the inventors of the 57-mm., 75-mm., and 105-mm. recoilless rifles. The awards were presented by Col. Ward E. Becker, commanding officer, Frankford Arsenal, in the presence of Mrs. Jones whose late husband was chief of the Philadelphia Ordnance District for many years and for whom the medal is named.

• **AT BOSTON.**—The spring meeting of the Yankee Post was held at the Hotel Bradford in Boston on May 17th.

Officers and distinguished guests included W. B. Loomis, Post secretary-treasurer; Ray M. Hudson, Post director; Harry A. Wansker, Post vice-president; John S. Pfeil, chief, Boston Ordnance District; Col. Carroll H. Deitrick, commanding officer, Watertown Arsenal; James L. Walsh, president, American Ordnance Association; George P. Slade, president of the Yankee Post; Brig. Gen. J. F. McManmon; Capt. Pleasant D. Gold, Jr., U.S.N., commander, Boston Naval Shipyard; Col. C. E. Bomar, chief, Management Office, Office of the Chief of Ordnance; Lieut. Col. Philip J. Kuhl, Air Force Matériel Command; John J. Brogan, Post vice-president; Carl B. Pitman, vice-president, Federal Reserve Bank; Lawrence J. Meyns, Post director; and Helge Holst, chairman of the Program Committee of the Yankee Post.

The principal speaker was Vice Adm. George F. Hussey, Jr., former Chief of Naval Ordnance, who discussed in detail the requirements for successfully doing business with the Government.

"In all dealings with the Government," Admiral Hussey said, "you are dealing as a businessman with a reputation of American business in your individual hands. As in the matter of subcontracting, don't try to bite off more than you can chew.

C. Walton Musser, second from left, and Dr. William J. Kroeger, second from right, both of Frankford Arsenal, jointly receive the John C. Jones Medal from Col. Ward E. Becker, right, commanding officer of Frankford Arsenal, for the invention and development of our recoilless rifles. The awards were presented at a meeting of the Philadelphia Post as Maj. Gen. Milton C. Baker, left, superintendent of Valley Forge Military Academy, and Lieut. Gen. E. H. Brooks, Assistant Chief of Staff, U. S. Army, watch the proceedings.

"I saw too many competent firms break down and tie up the production of several important prime contractors because of a failure to realize their inability to cope with everything which was asked of them and because of their honest but misguided efforts to meet those total requirements.

"Work with the contracting officer, the inspector, and the technical bureau or branch officers whom you encounter. . . . They are interested in seeing that only the best material for the purpose intended gets out to the fighting men afloat, ashore, or in the air."

• **AT EGLIN FIELD.**—The first meeting of the Florida Post was held at the Eglin Air Force Base on April 27th. The purposes of this meeting were to adopt a constitution and to elect a board of directors. Both purposes were accomplished.

By vote of the membership it was decided that the new Post would have a total of fourteen directors. Thirteen of the directors were elected during the course of the inaugural meeting, with one vacancy remaining open for a director to be elected in the future from the personnel of the Long Range Proving Ground.

The following members are now serving on the newly established board: Lieut. Col. Ray M. Sinnen, Lieut. Col. Robert F. Garner, Lieut. Col. R. L. Dickson, Maj. Julius R. Langley, Maj. Kenneth F. Fulton, Capt. Philip Steiner, Lieut. Herman L. Hawkins, Maj. Eugene E. Tepoorten, Dr. Howard E. Heinecke, James K. Abels, Robert C. Hoffman, Maj. Marjorie G. Hugo, and E. W. Williamson.

By vote of the membership it was decided that the board of directors, in turn, would elect from their own membership seven officers of the Post. This election was accomplished on May 7th. The new officers are Colonel Garner, president; Major Tepoorten, first vice-president; Dr. Heinecke, second vice-president; Tech. Sgt. Joel M. Pendergrass, first secretary; Tech. Sgt. Anthony Casper, Jr., second secretary; Tech. Sgt. Gennaro J. Rodia, treasurer; and Staff Sgt. Allison N. Earle, assistant treasurer.

The interim chairman of the Organization Committee was Col. T. J. Cummins, Jr., U.S.A.F. When Colonel Cummins received a new assignment, the duties in connection with the inaugural meeting were transferred to Major Tepoorten who demonstrated outstanding ability throughout the organizational phases of the Post's operations. The charter meeting, held on June 12, 1951, will be reported in the next issue.

• **AT NEW YORK.**—New York Post members to the number of 555 turned out for a buffet supper at the Hotel Astor on the evening of June 5, 1951, after which they heard a remarkably complete explanation of the Controlled Materials Plan by Walter C. Skuce, Assistant Administrator for Production Controls, National Production Authority.

In presenting Mr. Skuce to the audience, Vice Adm. George F. Hussey, Jr. (Ret.), president of the Post, remarked on the country's good fortune in having "the star of the original cast available for a repeat performance." Mr. Skuce demonstrated the validity of that comment by his very complete exposition of the Controlled Materials Plan. He pointed out the historical background of CMP in World War II and the various changes which had to be made during the course of its application.

He then discussed the CMP as it goes into effect on the first of July for materials required for defense production. He pointed out the many differences, some of which stem from the experience of World War II and others from the fact that in the present emergency materials for civilian production are not covered by CMP.

• **AT FORT WORTH.**—The Lone Star Post held its midyear meeting at Fort Worth, Tex., on June 16th. Invitations were extended to members of the Texas Post at Houston and the Mid-Continent Post at Tulsa, Okla. The principal speaker was Brig. Gen. Merle H. Davis who flew down from Washington for the occasion.

Plans are going forward to establish a chapter of the Post in El Paso. Organizational work is being carried on by C. A. Lindeman of the Darbyshire Steel Company. An exploratory meeting was held in El Paso on May 10th and an evening meeting, with interesting moving pictures, was held on June 8th.

The new project has enlisted the support and encouragement of a stalwart Ordnance officer, Col. George G. Eddy, commanding officer of White Sands Proving Ground, Las Cruces, N. Mex.

Officers of the enterprising Lone Star Post, with headquarters in Dallas, are G. G. McDonald, president; H. F. Haslbauer, vice-president; and W. O. Beeman, secretary-treasurer. Members of the board of directors include George W. Armstrong, Jr., G. H. Brown, S. P. Hamer, F. L. Lebus, C. E. Medley, Donald Mitchell, Stanley Patterson, and F. A. Pierce.

• **AT ST. LOUIS.**—The St. Louis Post has as its new president Granville A. Waters of Wagner Electric Company. The annual election of officers was held April 5, 1951. Col. Edwin B. Meissner, president and general manager of the St. Louis Car Company, who has served as president of the Post with great distinction, welcomed Mr. Waters to his new office and also the other elected officers and directors of the Post.

Following is the complete roster of newly elected officers: president, Mr. Waters; vice-president, Charles P. Whitehead, General Steel Castings Company; secretary, William P. Gatley, National Rejectors, Inc.; treasurer, Chris J. Senes, St. Louis Ordnance District.

The following directors will serve for the term of one year: Capt. Frank A. Brandley, U.S.N., commanding officer, U. S. Naval Air Station; Col. George W. Pardy, commander, Scott Air Force Base; and Col. J. D. Childs, deputy chief, St. Louis Ordnance District.

Directors to serve for a term of two years are: Vincent P. Ring, Knapp-Monarch Company; M. F. Peterson, Carter Carburetor Company; Spencer T. Olin, Olin Industries, Inc.; and Arden J. Mummert, McQuay-Norris Manufacturing Company.

The following directors will serve for a term of one year to fill unexpired terms: Colonel Meissner; Clyde H. Morgan, Emerson Electric Company; and Edward J. Judge, Scullin Steel Company.

Colonel Meissner was one of the founders of the St. Louis Post when, in cooperation with the late Col. Harry A. Scullin, the Post was founded on January 18, 1927. Colonel Scullin together with Col. H. M. Reedall and Colonel Meissner organized the Post for its great responsibilities which it has met with such success.

Shown above are the members of the recently established Citadel Post of the American Ordnance Association. This photograph of the new A.O.A. group was taken on the historic campus of the school at Charleston, S.C.

• **AT SYRACUSE.**—The Syracuse Chapter of the Empire Post (Rochester) held a joint dinner meeting with the Manufacturers Association of Syracuse in Syracuse on May 23rd.

The meeting, attended by more than two hundred leading industrialists from Syracuse and Central New York, was cochairmanned by H. Paul Nelligan, president of the Easy Washing Machine Corporation and chairman of the board of directors of the Manufacturers Association of Syracuse; and John D. Williams, vice-president of Lipe Rollway Corporation and chairman of the Syracuse Chapter of the American Ordnance Association.

Chapter Vice-Chairman Ray C. Malvin, works manager of the Fitzgibbons Boiler Company of Oswego, handled all meeting arrangements.

The two principal speakers were Raymond S. Smethurst, Washington attorney and former general counsel of the National Association of Manufacturers, who gave an experienced observer's viewpoint on the vital happenings at Washington during the mobilization emergency; and Comdr. C. W. Bahme, security coördinator, Office of the Chief of Naval Operations, who spoke on industrial security.

• **AT ANN ARBOR.**—The University of Michigan Post held an engineering open house on April 27th-28th. In setting up the open house the Post received very fine coöperation from the following companies: Kaiser-Frazer, Dodge Truck, Argus Camera, and King-Seeley.

In addition to providing several cars, Kaiser-Frazer put up a pentagon on which five industrial mobilization murals were placed. King-Seeley made up two excellent display boards of civilian and military production. Argus contributed several articles of a civilian and military nature. From Dodge the Post obtained the loan of an M43 ambulance and a ¾-ton M37 truck. Dodge also sent three Dodge ¾-ton civilian trucks.

The Post has also elected new officers. They are Gerald Fox, president; Jack Gillette, vice-president; and Ronald Modlin, secretary-treasurer.

The position of Engineering Council representative has been eliminated and the attendant duties and responsibilities have been given back to the president. The duties of secretary and treasurer have been combined this year.

• **AT PORTLAND.**—On a recent visit to the Columbia River Post, Robert L. Biggers, vice-president of the American Ordnance Association in charge of Posts, suggested a trip to the Rainier Ordnance Depot. Post officers and directors immediately went to work to follow through on the idea.

Members of the Post visited Rainier Ordnance Depot, near Tacoma, Wash., and two major defense industries in the Seattle area on May 11th and 12th, to observe manufacturing processes and to learn of the opportunities for securing subcontracts in and about Portland when large-scale defense production programs get under way in the Northwest area.

Members of the Columbia River Post are shown above on their recent visit to the Mount Rainier Ordnance Depot near Tacoma, Wash.

Col. O. E. Welch, commanding officer at the Rainier Ordnance Depot, was host to the group on the first day of the trip. The vast depot, which serves as the Ordnance base for supply, maintenance, and reclamation for Japan, Alaska, and the Northwest area, as well as an equipment point for troops passing through the Seattle Port of Embarkation, has been increased many times in size since the beginning of the Korean war. An interesting trip through the entire depot was conducted personally by Colonel Welch.

One of the interesting things pointed out, which should tend to lighten the heart of every taxpayer, was the reclamation program under which equipment returned from the Pacific islands and Alaska is being rehabilitated. This phase of the depot's work, which is costing approximately $2,500 a day, is daily reclaiming for reuse approximately $25,000 worth of equipment.

The group also was the first this year to be conducted through the Seattle and Renton plants of the Boeing Airplane Company where approximately 26,000 persons are employed. Principal productions are the B-50 Superfortress bomber and the C-97A Stratofreighter.

One of the interesting projects noted while inspecting the Renton plant was the modification being applied to a number of World War II B-29 bombers, converting them into KB-29 flying-boom tankers by attaching an aërial refueling system that utilizes a telescoping metal pipe to transfer gasoline under pressure from the tanker to the receiving airplane.

The Pacific Car and Foundry plant, producers of tracklaying gun carriers, was visited the afternoon of the second day. The company is the largest manufacturer of refrigerator cars in the United States and has a pay roll of approximately 1,700 persons.

• **AT PITTSBURGH.**—The Pittsburgh Post coöperated with the Pittsburgh Chapter of the Military Order of the World Wars in observing Armed Forces Day on May 19th. The observation took the form of a dinner meeting at the William Penn Hotel at which Adm. William M. Fechteler, Commander in Chief of the U. S. Atlantic Fleet, was the guest of honor and the principal speaker. Admiral Fechteler spoke on "Defenders of Freedom."

The Post has inaugurated an attractive and very readable newsletter which has become instantly popular with the membership.

Post officers are T. H. Eddy, president; T. E. Millsop, vice-president; J. K. B. Hare, vice-president; and W. S. Rial, Jr., secretary-treasurer.

Members of the board of directors, in addition to the officers, are J. A. Appleton, F. R. Denton, R. C. Downie, R. C. Enos, W. K. Fitch, K. C. Gardner, H. A. Gidney, H. B. Higgins, C. F. Hood, L. Iversen, G. H. Love, Ben Moreell, Brehon Somervell, A. E. Walker, and I. W. Wilson.

• **AT CINCINNATI.**—The Cincinnati Post, under the highly capable leadership of Louis Polk, is considering the desirability of contributing a library of ordnance literature to the engineering colleges in its area to stimulate interest in ordnance.

James L. Walsh, Association president, suggested the books listed in a "Reading Course in Ordnance" prepared by F. W. F. Gleason which appeared in the January-February 1950 issue of ORDNANCE, supplemented by the following list:

Maj. Gen. James M. Gavin's "Airborne Warfare," Gen. George S. Patton's "War As I Knew It," Col. S. L. A. Marshall's "The Soldier's Load and the Mobility of a Nation," The Smythe Report

on Atomic Energy, Marshall Andrews' "Disaster Through Air Power," Dr. Vannevar Bush's "Modern Arms and Free Men," Gen. H. H. Arnold's "Global Mission," George Fielding Eliot's "If Russia Strikes," Gen. Augustin Guillaume's "Soviet Arms and Soviet Power," Maj. Gen. J. F. C. Fuller's "The Second World War," B. D. Munhall and H. P. White's "Cartridge Identification, Vol. I: Central Fire Metric Pistol and Revolver Cartridges," Gen. Dwight D. Eisenhower's "Crusade in Europe," Douglas Southall Freeman's "George Washington, Vols. I and II: The Young Washington," Arnold J. Toynbee's "Civilization on Trial," Gen. Joseph Stilwell's "The Stilwell Papers," Robert H. Connery's "The Navy and the Industrial Mobilization in World War II," Fleet Adm. William D. Leahy's "I Was There," Winston S. Churchill's "The Grand Alliance" and "The Hinge of Fate," Lieut. Gen. Robert L. Eichelberger's "Our Jungle Road to Tokyo," Brig. Desmond Young's "Rommel, The Desert Fox," and William L. Laurence's "The Hell Bomb."

• **AT LANSING.**—One hundred and thirty representatives from Michigan industries and from agencies serving these industries attended a conference on the production of Ordnance manuals sponsored by the Lansing Chapter of the Michigan Post, American Ordnance Association, in Lansing on April 20th. The conference, according to F. A. Edwards, chief of the Military Publication Section, Office, Chief of Ordnance, Washington, D.C., was a pioneer venture in that it brought together so large and diverse a group for instruction on manual production. Mr. Edwards was one of the principal speakers at the meeting.

Arnold G. Schneider of Raritan Arsenal, Metuchen, N.J., followed Mr. Edwards on the program after he had discussed "The Theory of Ordnance Manuals." Mr. Schneider's topic was "Aiding the Contractor in Preparation of Ordnance Publications," and he traced the steps of ordnance manual production from beginning to conclusion.

A panel discussion on manual-production problems brought together George W. Fenn, Reo Motors, Inc., Lansing; Paul E. Cattey, Nelson Associates, Inc., Detroit; Mr. Edwards, and Mr. Schneider. Eldon Robbins, executive-secretary of the Lansing Chapter, was chairman of the conference.

• **MICHAEL GRATIAN YATSEVITCH**, leading Ordnance metallurgist, chemist, and scientist, died on May 9, 1951, in Schuylerville, N.Y., at the age of 71. For his war service he received decorations from former Secretary of War Robert Patterson and the late President Franklin D. Roosevelt. Born in Altai, Siberia, he studied at the National Scientific School in Tomsk, Siberia; Polytechnic Institute of Emperor Alexander II at Kiev, Russia; and Leipzig and Harvard Universities.

Dr. Yatsevitch investigated iron works in South Russia in 1908, 1911, and 1912. On behalf of the Imperial Ministry of Trade and Industry of Russia he studied metallurgy and allied industries and higher technical education in the United States and Canada from 1913 to 1916.

From 1916 to 1918 he served as chief engineer of the special council on fuels in charge of special research work on the development and industrial application of oil shales in Estonia and Russia, resulting in a new oil-shale industry in Estonia. He was a consulting engineer in London from 1919 to 1926, when he was appointed a metallurgist of the Ordnance Department, United States Army, at Watertown Arsenal, Mass.

Dr. Yatsevitch made an outstanding contribution to the national defense of the United States in his work to improve the high quality of Ordnance matériel during the last quarter century. More than this, however, was the influence and guidance which he exerted to develop the intellect and the character of the hundreds of Ordnance officers with whom he worked and whom he taught at Watertown.—DANIEL J. MARTIN.

• **FRANKLIN W. OLIN**, 91, founder of Olin Industries, Inc., and a lifelong member of the American Ordnance Association, died May 21, 1951, at St. Louis, Mo. Because of his ingenuity and diligence, the little powder plant Mr. Olin started in East Alton, Ill., fifty-nine years ago, grew to be one of the giants of American industry and a tribute to its founder's work.

Known as the dean of American sporting arms and ammunition, Mr. Olin did much to develop and improve not only the materials needed by United States servicemen in three wars but also the arms and ammunition used by sportsmen.

Long an advocate of the free-enterprise system, F. W. Olin had the vision to multiply the skills of his boyhood and turn them into the manufacture of some of the world's best-known products. His inventive mind was quick to grasp new problems and turn them into successful ventures which included the manufacture of explosives, nonferrous metals, sporting arms and ammunition, dry batteries and flashlights, and many other products.

Born in Woodford, Vt., January 9, 1860, Mr. Olin overcame early obstacles and rose to a commanding position as one of the most important and influential industrial leaders of the Nation.

Mr. Olin came to the Midwest in 1892 in search of a site at which he could manufacture industrial explosives to better serve the growing coal fields of the area. He selected a wooded, swampy area at East Alton, Ill., and it was here that his first company, the Equitable Powder Manufacturing Company, began. Hunters' demands for more sporting ammunition brought about Mr. Olin's decision to enter that field, and in 1898 he founded the Western Cartridge Company, again at East Alton, and began supplying hunters and trap, skeet, and target shooters with ammunition.

Mr. Olin acquired the historic Winchester Repeating Arms Company of New Haven, Conn., in January 1932. He retired as president of Western Cartridge Company with the formation of Olin Industries, Inc., December 31, 1944, of which his son, John M. Olin, is president and another son, Spencer T. Olin, is first vice-president.

His charities, innumerable and frequently anonymous, included religious, educational, and research contributions. Two of his better-known gifts include over one million dollars which he gave for educational purposes.

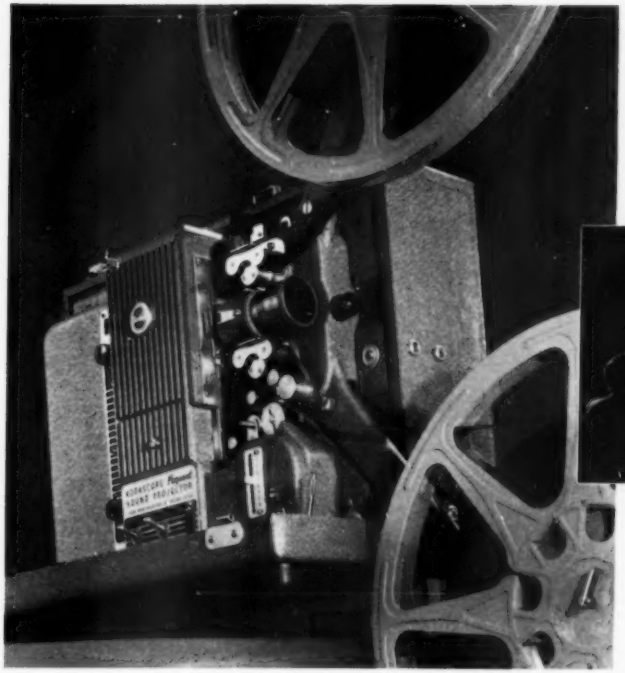
In time of national emergency Mr. Olin met the needs of the United States and its fighting men. In World War I Western Cartridge completed extensive production for the United States and the Allies. Olin war workers, during World War II, produced more than 15 billion cartridges, nearly 1½ million rifles and carbines, more than 1½ billion pounds of brass, and scores of other items in tremendous quantities for the defense forces.

• **CHARLES BAYNARD LISTER**, executive director of the National Rifle Association and long a member of the American Ordnance Association, died in Washington, May 14, 1951. He was editor of the *American Rifleman* and had been an official of N.R.A. for twenty years.

A native of Wilmington, Del., Mr. Lister began his service with the Rifle Association in 1921; five years later he became secretary-treasurer of N.R.A. During the Second World War he was national coördinator of rifle shooting under the Office of Civilian Defense. He was responsible for a program to organize the trained marksmen of more than 2,000 civilian rifle clubs for semimilitary purposes.

Throughout his entire service he was an outspoken proponent of antigun legislation. Officials of many States were in frequent consultation with him concerning model firearms-control laws.

Throughout the years he worked in closest coöperation with the American Ordnance Association, among whose members his memory will be kept in deep affection.



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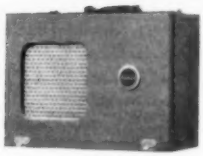

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New Developments

LIGHTER LOAD

The Army hopes to reduce by as much as sixty-five per cent the weight of items which soldiers must carry into combat, according to Gen. J. Lawton Collins, Army Chief of Staff, who said in a recent speech: "Almost every item that the soldier carries is being examined and wherever possible is being made lighter. We hope to save as much as sixty-five per cent, primarily by the use of lighter metal alloys and other lighter materials. A few of the items in which we are making progress are a new rifle, a new pistol, new machine guns, new ammunition. Our new 3.5-inch bazooka, for example, weighs less than the original 2.36-inch model. We also have a new intrenching tool that will replace the shovel, pick-mattock, and axe. This one item will cut three pounds, fourteen ounces from the soldier's load. The new aluminum-nylon helmet will save eight per cent in weight but will give fifteen per cent more protection. New tropical combat boots under development will be three-fourths of a pound lighter than our regular boot. We are even reducing the weight of the soldier's eating equipment by almost a pound."

CONVERTIPLANES

The design competition conducted by the Air Force for a "convertiplane" combining the take-off and landing characteristics of the helicopter with the speed and range performance of fixed-wing aircraft, has been completed, and three designs have been selected for further development. Companies submitting winning designs were the McDonnell Aircraft Corporation, Bell Aircraft Corporation, and the Sikorsky Division of United Aircraft Corporation.

SMALL MINESWEEPERS

The Navy has developed new "piggyback" minesweepers, which will be carried by mother vessels and then turned loose on the spot to clear mine-infested waters. Development of the new minesweepers by the U. S. Navy will enable fast task forces to operate at peak efficiency in enemy waters. During World War II, independent naval forces were frequently hampered by mines because they did not always have the relatively slow minesweepers accompanying them to clear their way.

General Electric will provide special generator sets, auxiliary propulsion units, and controls for forty-five of the small vessels. Similar equipment will also be used on larger minesweepers ordered by the Navy at the same time.

NEW AMPHIBIAN

The Otter, latest Army cargo carrier, is expected to replace the older Weasel as

Defense photo

The Otter amphibious vehicle.

a general-purpose amphibious vehicle. Technically known as the T46E1, the Otter has a land speed of thirty-six miles an hour and is said to operate well in snow and tundra. Developed by Army Ordnance, the vehicle is easily steered by means of a wobble stick.

NEW GREASE

Three years of persistent work at Aberdeen Proving Ground have paid off with a new grease good in any climate. Army Ordnance scientists developed the new lubricant which does the job at 65 below zero or at 125 above. The Army may now use this one type of grease for its trucks, tanks, gun carriers, and other vehicles instead of the six different types formerly required.

MAGNESIUM COATING

A new treatment for magnesium known as the HAE process was announced recently by the Chief of Army Ordnance. The HAE process is outstanding in the protection of magnesium against abrasion, corrosion, and erosion. Developed by H. A. Evangelides, the new process produces electrolytically a hard, adherent, refractory ceramic coating in a manner similar to anodizing. The abrasion resistance of the coating is many times superior to that of any other coating for magnesium known. Waxed specimens have been exposed to salt spray for over 6,000 hours with no sign of corrosion.

MIGHTY MIDGET MAGNET

A cobalt-platinum magnet, which in small sizes is described as the world's most powerful permanent magnet, has been developed by scientists of the General Electric Research Laboratory. Compared with Alnico-5 magnets, generally rated as the most powerful in commercial use, the new magnet is less powerful in large sizes but more powerful in small sizes. Laboratory experiments with a new magnet about the size of an eraser on a lead pencil, and a similar-sized Alnico-5 magnet, show the new magnet to have lifting power twenty-four times greater than that of Alnico-5, and about eight times more resistance to demagnetization. Other advantages of the new magnet are its ductility, or ability to be drawn into wire or thin sheets, and its comparative ease of machining.

AUTOMATIC WEATHER STATION

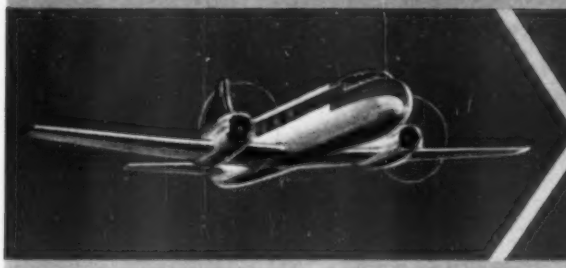
A self-contained automatic weather station, which transmits weather data by radio, has been developed by Percival D. Lowell and William Hakkarinen of the National Bureau of Standards for the Navy Bureau of Ships. Named the "Grasshopper," the device can be parachuted from aircraft onto inaccessible territory where it will automatically set itself up and periodically make and transmit weather observations. It may also be used as a radio marker beacon.

After the station has parachuted to earth, controlled explosive charges are used to disengage the parachute, raise the station to an upright operating position, and erect a telescoping antenna. Weather-responsive devices then cause resistance changes which switch a radio transmitter on and off at a rate susceptible of translation by a receiving station into temperature, pressure, and humidity readings.

SUPERSONIC WIND TUNNELS

A 180,000-horsepower wind-tunnel drive —the greatest power output ever to be concentrated on a single shaft was ordered recently by the National Advisory Committee on Aëronautics. The giant electric motor unit and a companion 110,000-horse-

FOR THE AIRLINES *Convair 340*

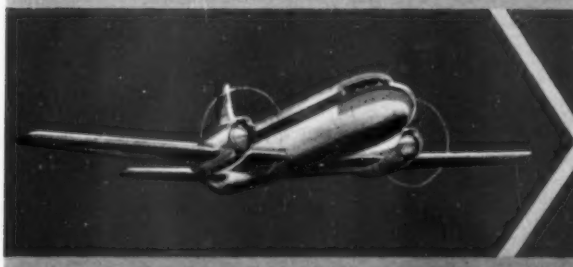


An advanced version of the incomparably dependable Convair 240, America's newest luxury airliner, the Convair 340, with every travel convenience for 44 passengers, is the largest and finest twin-engine transport ever ordered for airline service.

FOR THE MILITARY *Convair T-29*

World's first navigator-bombardier trainer providing instruction and experience for relatively large groups of students, the Convair T-29, U. S. Air Force version of the Convair-Liner, is a significant contribution to America's rapidly expanding air power.

FOR THE FUTURE *Convair-Turboliner*



The sturdy and efficient Convair-Liner airframe has demonstrated complete adaptability to the installation of gas-turbine power plants. America's first turboprop transport, the Allison Convair-Turboliner, already has accomplished a series of successful test flights.

IN THE AIR -- IT'S *Convair*

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	DECIMAL	B. W. GAUGE	DECIMAL	B. W. GAUGE
1/2"	.065"	16	.028"	22
5/8"	.065"	16	.028"	22
3/4"	.065"	16	.028"	22
7/8"	.083"	14	.028"	22
1"	.109"	12	.028"	22
1 1/8"	.109"	12	.028"	22
1 1/4"	.134"	10	.028"	22
1 3/8"	.134"	10	.028"	22
1 1/2"	.148"	9	.035"	20
1 5/8"	.148"	9	.035"	20
1 3/4"	.148"	9	.035"	20
1 7/8"	.165"	8	.035"	20
2"	.165"	8	.035"	20
2 1/4"	.180"	7	.035"	20
2 1/2"	.203"	6	.035"	20
2 3/4"	.203"	6	.035"	20
3"	.220"	5	.049"	18
3 1/4"	.220"	5	.049"	18
3 1/2"	.238"	4	.049"	18
3 3/4"	.238"	4	.049"	18
3 7/8"	.238"	4	.049"	18
4"	.238"	4	.049"	18
4 1/4"	.250"	3	.065"	16
4 1/2"	.250"	3	.083"	14
4 3/4"	.250"	3	.083"	14
5"	.180"	7	.083"	14
5 1/2"	.180"	7	.083"	14

*Intermediate sizes within the range indicated can also be manufactured. Please consult us for sizes not listed.

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EQUIVALENT SQUARES, RECTANGULARS AND SPECIAL SHAPES ARE ALSO AVAILABLE.

New Developments

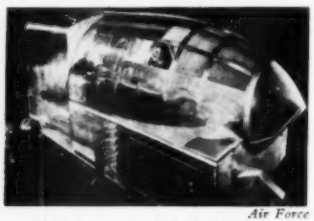
power drive will be installed in two supersonic wind tunnels at N.A.C.A.'s Ames Aëronautical Laboratory, Moffett Field, Calif.

The 180,000-horsepower installation will be used to power a new record-breaking 8-foot tunnel which will create wind velocities several times the speed of sound. The drive will consist of four 45,000-horsepower, 720-r.p.m., variable-speed AC induction motors mounted in tandem on a single shaft to drive either of two axial-flow compressors.

The second unit, rated at 110,000 horsepower, will be used at the Ames Laboratory's present 16-foot tunnel, replacing the 27,000-horsepower drive installed there a few years ago. Using three propellers operating on a single shaft, this tunnel will create wind velocities ranging from 350 to 920 miles an hour.

FLIGHT SIMULATORS

Flight simulators now being procured by the Air Force will offer valuable in-flight training for flight personnel in



Air Force

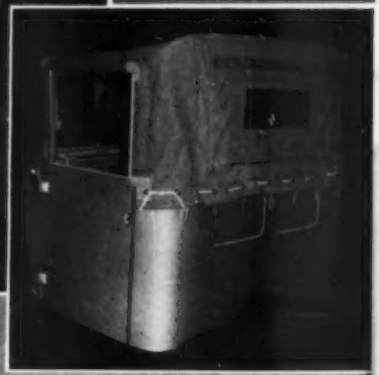
Exterior view of flight simulator.

many types of planes, at reduced cost and with perfect safety, as compared with actual flight training. First developed for use by P.A.A. in training Stratocruiser crews, simulators soon available will duplicate cockpit installations of B-47, B-36, and B-50D bombers, C-124 and C-97 cargo planes, and the F-86D interceptor. Each will include a "hell box" with which instructors can plague crews with such troubles as icing, engine fires, loss of fuel pressure, and instrument landings, but with the advantage of being able to switch back to neutral after the "crash" with no damage to either aircraft or crew.

OZONE FOR ROCKETS

Concentrated liquid ozone has been proposed as a rocket fuel by Prof. Clark E. Thorp of the Illinois Institute of Technology, who recently disclosed advances made at the Institute by which ozone can be handled with safety. Ozone is a form of oxygen with three atoms to the molecule instead of two as in ordinary life-supporting oxygen. By demonstrating that it can be safely manufactured, Professor Thorp stated, the door has been opened for tonnage production. During World

BEN R. MITCHELL
pictured at left, president of Ionia Mfg. Co., points out the features of the Ionia-built truck cab top cover assembly being produced for the U. S. Army Ordnance Dept. for "Super Beaver" and other trucks.



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is currently producing a wide variety of items for the armed services.

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has complete facilities for prime- and sub-contracting.

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has the "know-how" to handle your problems. May we help you?

Ionia Manufacturing Co., in World War II proved that it has the organization, the plant facilities and the know-how to manufacture almost any product. We're ready again — and are already proving it — producing items necessary to the national defense. Our tremendous facilities are at your call: more than a million square feet of usable floor space; a ready market of skilled and semi-skilled labor; and a strategic location in the very heart of the vast midwestern industrial empire. Whatever the product, whatever your production requirements — it will pay to check first with Ionia!

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STANDARD APPLICATIONS FOR CHIKSAN AIRCRAFT SWIVEL JOINTS
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No need to waste precious time... and money... on design, mock-up and testing to develop Swivel Joints for your flexible lines. CHIKSAN *Ball-Bearing* Swivel Joints are proved *now* for all kinds of applications.

With CHIKSAN Swivel Joints, you can build flexible lines with all-metal tubing which permit tight bends and fit into limited space... lines which permit unlimited flexibility without drag or sag... lines which assure maximum safety and dependability under pressures to 3,000 psi. (to 15,000 psi. on industrial applications).

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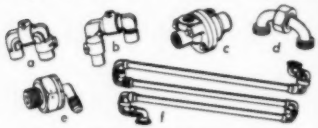
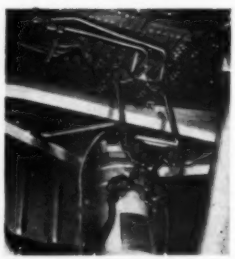
(a) Basic Type Swivel Joints – for pressures from 125 psi. to 15,000 psi. (b) High Temperature Swivel Joints for temperatures to 500° F., working pressures to 700 psi. (c) Rotating Joints for 150-lb. steam, brine, etc. For hot and cold rolls, tumblers, platens, etc. (d) Sanitary Swivel Joints for food processing, fruit juices, dairies, etc. (e) Hydraulic Swivel Joints for pressures to 3,000 psi. For aircraft, industrial and armored equipment. (f) Flexible Lines, designed and fabricated to meet specific requirements.



WRITE FOR CATALOG NO. 50-AH

Representatives in Principal Cities



1 Typical CHIKSAN installation on hydraulic lines for aircraft landing gear.

2 Brake line installation on torque link in aircraft brake system.

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BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

New Developments

War II, German scientists worked overtime on an ozone-propelled rocket designed to bombard New York City from European launching platforms. But they were unable to discover the secret of handling ozone without spontaneous detonation.

SQUARE PARACHUTE

An expendable cargo parachute made of cotton muslin, perfected by the USAF's Air Research and Development Command,

Air Force

New muslin cargo parachute.

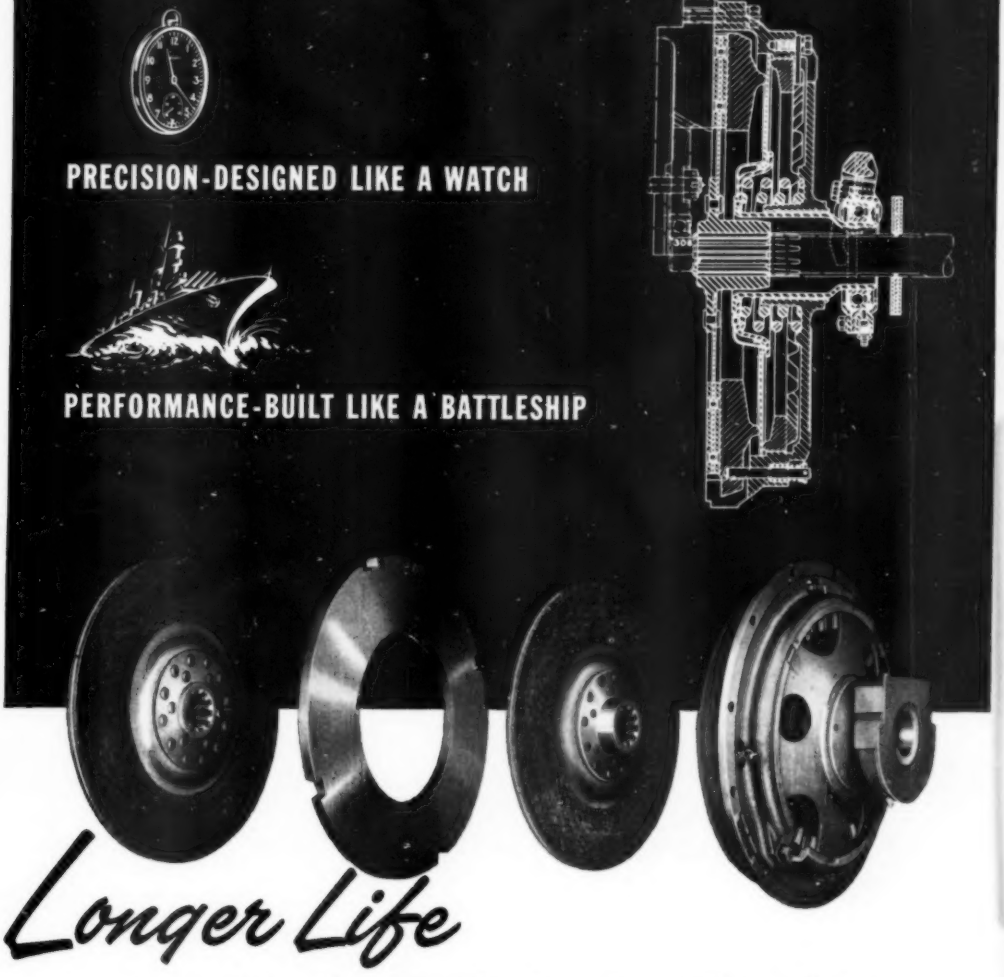
will replace the old 24-foot rayon cargo chute and, in clusters of three or four, will do the job of the 64-foot nylon chute presently used for heavy drops. The new G-13 type chute is made of nine strips of material forming a 28-foot square, will deliver a 500-pound load from a plane doing 175 miles an hour. The G-13 chute costs only half as much as the rayon chute; a cluster will cost one fourth as much as the big nylon type. It is deployed direct from its shipping container, an ordinary cardboard box, instead of the conventional canvas pack.

INDEPENDENCE

Pratt & Whitney Aircraft is now producing turbojet engines entirely from materials available in the Western Hemisphere. Dependence on metal imports from Asia, Europe, and Africa has been completely eliminated in production of the J-48 Turbo-Wasp, the most powerful jet engine now being delivered to the U. S. Air Force and Navy.

NEW MINING DEVICE

A nonexplosive device for breaking down coal has been developed by the Du Pont Company. It is a chemico-mechanical device which breaks coal from a mine face by the force of compressed gas generated



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proved in the heaviest automotive duty

Spicer Brown-Lipe Clutches offer these exclusive service features:

BUILT-IN PARALLELISM assures uniform pressure around entire circumference of pressure plate regardless of wear or adjustment.

ALL PARTS INDIVIDUALLY BALANCED means that replacing a part will not impair balance of assembly.

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ALLOY PRESSURE PLATE of nickel chromium alloy minimizes destructive warping, heat checking and scoring.

INSTANT ADJUSTMENT for wear is made by turning threaded adjusting ring. No special tools needed.

OTHER FEATURES include prevention of oil leakage; no bearing face wear; low temperature springs; smooth pick-up; single and two-plate models for heavy duty in all transportation services.

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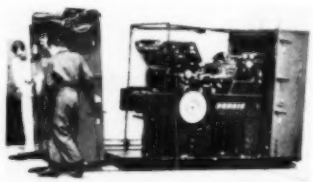
by chemical reaction within the device and released mechanically. It consists of a steel tube enclosing a chemical unit. The tube is closed at one end by a plug having electrical connections, and at the other end by a rupturable disk held in place by a perforated head.

After the tube is placed in a hole drilled in the coal face, the chemical reaction is activated by an electrical current controlled within narrow limits. Heat is produced which after a few seconds destroys the starter wire, thus breaking the electrical circuit. The chemical reaction thereafter continues to liberate gas which builds up to a predetermined pressure, at which point the disk ruptures. The gases rush out through the ports in the head and break down the coal. The tube can be used repeatedly.

FLYING PRESS

A "flying printing press" developed under Air Force Aeronautical Chart and Information Service guidance combines a



Portable offset printing press.

complete offset printing press with all tools, auxiliary equipment, and supplies in an 8,000-pound package transportable by Air Force cargo planes. The portable press room is carried in a shipping container made of cabinets and panels which break down to form needed press-room facilities. The unit can be unloaded and in operation within two hours. Press capacity is 6,500 sheets of 22½ x 30-inch stock an hour.

NEW TANDEM GEAR

A tandem-type gear installation has been developed and tested by the Fairchild Aircraft Division to provide C-119 Packets with a wider landing "footprint." The new gear will increase the utilization of Packets for landing on unprepared fields with rough sod or soft surfaces. The experimental gear resembles the one currently used on production models of the C-119 in that it consists of the same essential strut arrangement. However, in place of the axle carrying two side-by-side wheels, a truck has been mounted on a pivotal fitting on the main oleo strut which carries four wheels, slightly smaller than those used on the present Packet.

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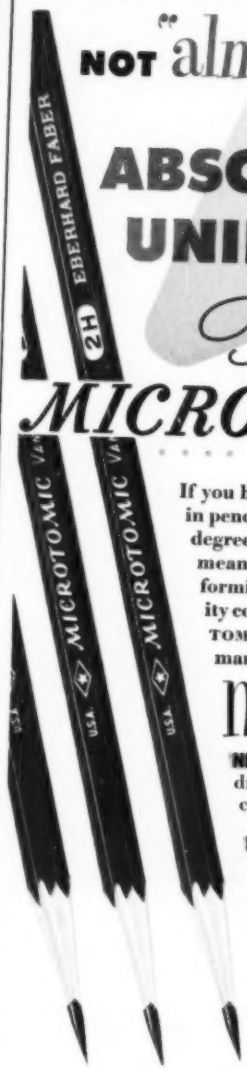

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PICKLING ACID INHIBITORS

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SAVES STEEL
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Use RODINE in sulfuric and muriatic acid baths for improved pickling and increased production.

In straight line pickling of wire, rod and tubing, RODINE makes available more metal for drawing by protecting steel from acid attack. In batch pickling of sheet steel, RODINE improves the surface. In rapid, continuous strip pickling, RODINE not only saves acid and metal, but also prevents over-pickling during line shutdowns.

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COMMUNICATIONS

LIDDELL HART ON "DEFENCE"

THE EDITORS.—Hoffman Nickerson's views about the higher conduct of war have so long tended to coincide with my own conclusions that it is a puzzle why he invariably shows a peculiarly carping attitude whenever he has a chance to review any of my books. His recent review of "Defence of the West" conforms to his rule. He devotes the opening half column to a series of niggling little criticisms of a personal kind, and then in the next four columns expresses his agreement with most of the main conclusions in the book!

His apparent desire to point out offsetting faults leads him into extraordinary irrelevances in that first half column. They are so wide of the mark that they would not call for an answer but for their tendency to create prejudice. Mr. Nickerson's initial criticism of me is:

"Much of his 'Ghost of Napoleon' coincides so closely with Colin's 'Education Militaire de Napoleon Premier' that readers of both have wondered why he never acknowledged indebtedness to Colin."

That book was a short account of the evolution of military thought from the eighteenth to the twentieth century, given as lectures at Cambridge. Only a small part of it dealt with Napoleon's military education. But in my list of sources I not only emphasized Colin's book but devoted the best part of a page to special praise of his pioneer work on that period. Any one can check this by looking up the U. S. edition of my book (pages 191-192), published by the Yale University Press—and it is hard to understand how Mr. Nickerson failed to note the acknowledgment.

He concludes his opening burst of criticism by another complaint of lack of generosity on my part, this time in "Defence of the West," saying:

"Similarly, it would have been more generous on page 33 to have mentioned by name a few of the British soldiers, Fuller and Martel for instance, who urged after the First World War that tank forces should be supplied by caterpillar-tractored transport."

On page 33 I was dealing with the Germans' offensive in Russia and the forfeit they paid for lack of tracked transport. It would not have been appropriate to do more than make incidental reference to the fact that in Britain "the leaders of the new school . . . after 1914-1918 urged that the new model forces should have tracked vehicles throughout." But in Chapter XIX, which deals with "Armored Forces" as a whole, I pay particular tribute to Fuller and Martel.

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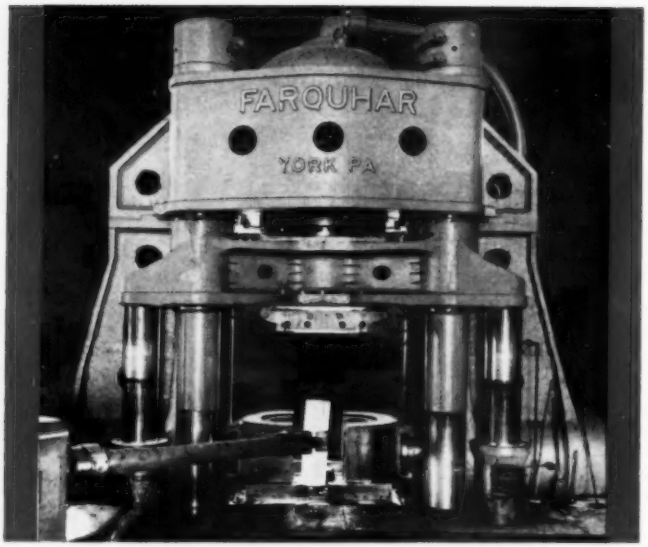

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Farquhar offers you a complete line of rugged hydraulic presses . . . ranging from 3 to 9,000 tons capacity . . . to help you turn out defense production at *less cost* in *less time!* The Farquhar line includes housing, column and gap type presses for practically all phases of metalworking and many operations in the rubber, ceramics, plastics and plywood industries.

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If your plant is tooling up for any kind of defense production, you'll be time and money ahead to consult with Farquhar engineers *right now* for competent, experienced advice in installing the dependable Farquhar equipment that will help you fulfill government contracts in a hurry! Give us a call today!

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Extruding • Jogging • Forging • and other Metal-working Operations

Communications

Another "personal" criticism of Mr. Nickerson's is that "Defence of the West" "suffers from the unblushing statement on pages *228* and *229* that Patton's great drive across France was inspired chiefly by a conversation with Liddell Hart himself. Those who remember Patton's dashing temperament and long study of mechanized warfare will charitably suppose that a few courteous phrases on his part may have been taken too seriously."

No such statement is made in my book—as can be seen by any one who cares to look up the pages that Mr. Nickerson cites. The only phrase of General Patton's quoted is the opinion he expressed (in March 1944) that when the Allied armies invaded France they would have "to go back to 1918 methods" and would not be able to repeat armored drives like that of 1940. There is nothing particularly "courteous" about that nor anything that could be misunderstood. Moreover I emphasized that the remark he made merely repeated what had just previously been said by our leaders at an inter-Allied military conference.

Maj. Gen. John S. Wood, commanding the U. S. 4th Armored Division and an ardent believer in the bold use of armor, had been very disturbed at the way such slow-motion views were accepted and was anxious lest even General Patton might be led to accept them. He urged me to see Patton and put the contrary arguments. Patton's remark early in our talk showed that there was ground for Wood's anxiety. But the only thing I say in the book about the effect of my argument is: "This argument seemed to appeal to him—it fitted in with his own mobile instincts better than did the arguments in higher quarters to which he had momentarily acceded."

For my part I was reluctant to put my arguments to Patton, and only did so after Wood had assured me that they would be welcome and that my opinion carried weight with Patton. General Wood presumably knew what Patton thought better than Mr. Nickerson does.

Why, however, does he find it so incredible and unpalatable that my arguments could have had any effect?

Patton (and Wood, with the spearhead) strikingly redemonstrated in the 1944 armored drive the practical value of the strategic ideas which General Guderian had demonstrated in 1940—the first time those ideas were decisively demonstrated in warfare. Guderian was not too proud to acknowledge the influence of my exposition of those ideas. As most students of armored warfare know, Guderian has recorded that I was his "first teacher in tank tactics and strategy" and described himself as "Liddell Hart's disciple."

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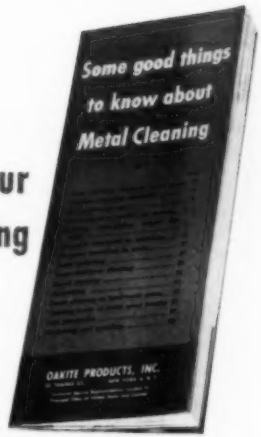

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After that testimony, any subsequent one is superfluous. Patton was one of the greatest practical exponents of armored warfare, but he was a comparatively late convert to the idea. It is childish on the part of supersensitive "fans" to deny that he could have been influenced by any one else's suggestions. Patton himself was more generous.

It has now become an article of faith in totalitarian Russia that every new idea in modern times was of Russian origin. One of the latest claims there is that a Russian invented the tank. Mr. Nickerson's outraged tone would suggest that there are Americans who hold the belief that the conception of fast-moving armored warfare originated with Patton.

Another of Mr. Nickerson's assertions is that my prewar assessment of modern defence "was vehemently contradicted by the long series of brilliantly successful offensives in the Second World War." The best answer to that notion is provided by Guderian and Rommel. They evidently understood my meaning and teaching better than Mr. Nickerson does even yet. To overcome the power of defence with modern weapons required a great superiority of strength *or* a new technique of attack. That proved true throughout the war, and remains true. Only a remote or superficial view can fail to see it now.

B. H. LIDDELL HART

Buckinghamshire, England

MR. NICKERSON REPLIES

THE EDITORS.—As to my statement that in his "Ghost of Napoleon" Liddell Hart did not acknowledge his indebtedness to Colin, I am glad to have my error corrected. I was misled by the fact that his text does not mention Colin's admirable summary of Bourcet's and Guibert's doctrines and I overlooked his bibliographical note at the end of that book.

As to his claim to have inspired Patton's great sweep across France, I have not questioned his account of the facts of his conversations with the General. I question fundamentally his interpretation of those facts. Patton's well-known temperament and lifelong study of war make it very difficult to believe—to put it mildly!—that his ideas of generalship were profoundly modified by talking with any military critic in the spring of 1944.

HOFFMAN NICKERSON

Oyster Bay, N. Y.

ON STRATEGIC BOMBING

THE EDITORS.—I have read and studied the article "Wrong Target" published in the Armament Technology section of the March-April 1951 issue of ORDNANCE. Colonel Shaw and ORDNANCE magazine should be complimented very highly for publishing such a detailed analysis.

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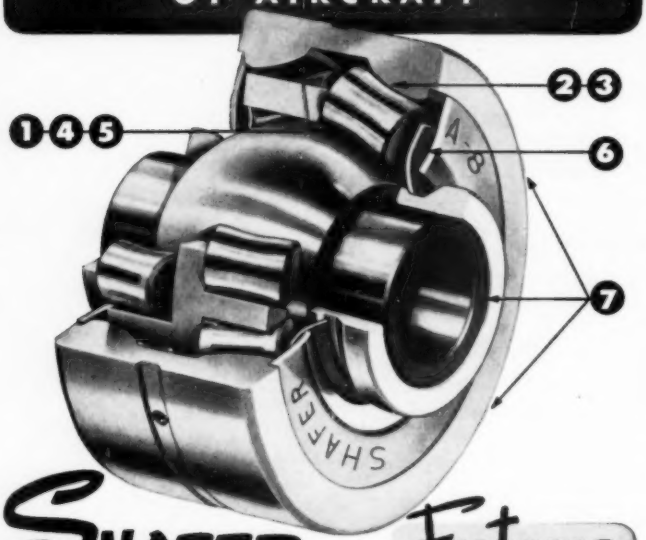

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The use of strategic air power certainly demands close scrutiny and sincere objective thinking. The analysis made in "Wrong Target" should be "must reading" for all groups studying this problem. It is certainly gratifying to a layman or civilian to see such data made available.

Of course, the writer had a special interest in this article as I was one of 300 "civilian engineers" enrolled in the U. S. Strategic Bombing Survey in the European Theater during 1945. I would like to comment on portions of the study made in "Wrong Target" with which I agree in the over-all opinion arrived at by Colonel Shaw.

1. "Far from destroying the enemy's morale and reducing his war production, *it spurred him on to ever-higher levels of production.* As our bomb tonnages increased, from 1942 on, so did his industrial output. The reports of the Survey are conclusive: 'Within 2½ years (the period of the increasing air attack against industry) Germany's military output in aircraft weapons and ammunition was raised more than threefold, in tanks nearly sixfold'."

I don't think this is a fair conclusion. The U. S. increased production in war products, too, and we did not require bombing to "spur us on." Germany had not really taken the war seriously until 1942 and 1943. Their *Aufstakung* or "doubling of production" was not instituted until Albert Speer took over and really planned military output in late 1942. I do not think bombing "spurred on German production"; it definitely and fortunately *retarded* their *anticipated production* and kept the Germans from having more airplanes, V weapons, and tanks, than they did have.

2. "There is no evidence that the attacks on the ball-bearing industry had any measurable effect on essential war production."

Having been an engineer in the anti-friction bearing industry in the U.S.A. for twenty-five years and having followed its effect on war potential in World War II in the U.S.A., I am sure that the individual attacks on the German bearing industry and the over-all bombing attacks did have a very measurable effect on essential war production in Germany, and I am sure that you should not summarize the "Bearing Investigation Report" so briefly as you have above.

If we consider only the following factors, the raids on the ball-bearing industry *were* effective: (a) The manpower used for dispersal of some 150 small unit plants due to raids or fear of raids; (b) The man-hours lost in air-raid shelters; (c) The man-hours lost in repair of damaged buildings and machinery; (d) The money used for underground plants—over fifteen million reichsmarks; (e) The tech-

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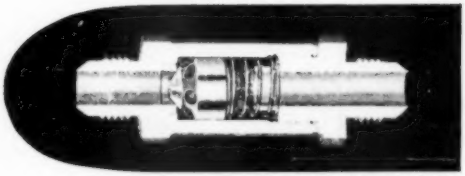

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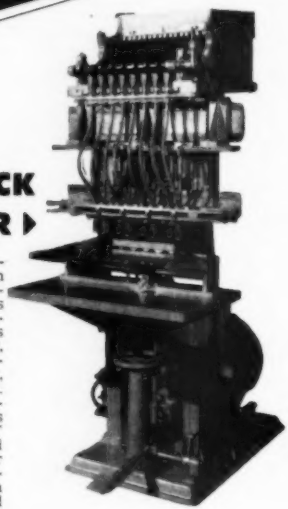

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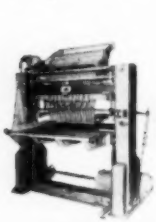

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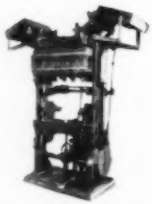

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nical skill absorbed in combating the continuous interruption of production.

All the above was taken out of potential available resources for furthering the production of combat items such as guns, planes, ammunition, etc. Therefore, the Germans did not have what they needed to prolong or win the war.

3. "The consequences of the breakdown in the transportation system were probably greater than any other single factor in the final collapse of the German economy. The lateness of the effective attack upon transport in relation to the completion of military operations prevented the full cycle of its effects upon production of military items from becoming apparent in the supply available to the armed forces."

This is quite true, but it was made more apparent and effective by these factors: Because of bomb raids on industrial targets the Germans were forced to great and elaborate (in fact indiscriminate) dispersal systems—scattering production facilities all over the country and adding many miles to the process routes of manufacturing plants. Thus the conditions were ripe for transportation as a target. Because of bomb raids on petroleum products the dispersal transportation systems became more vulnerable to bombing attacks, hence the late attacks were much more effective.

4. "If a strategic transportation plan of attack had been followed from the earliest moment possible, or not later than May 1943, not only would the German troops opposing the Normandy landing have been deprived of fuel stocks described as 'at their highest level' but the gasoline starvation of the German Air Force would have commenced far earlier."

We only had so many planes and so much air power in 1942 and 1943, and if we had employed it against transportation to a much greater degree than we did we would not have bombed other targets that were selected. The Germans then would have used the same manpower for repair of transportation that they used for repair of the other targets selected and the selection of transportation may not have been as detrimental as it was later on.

I certainly agree that a more consistent and effective over-all plan could have been adopted—but that is *after* we had seen the effects of the World War II plan.

I certainly think we should study, plan, and analyze the results, like Colonel Shaw has done, for future planning. I think we all have learned a lot and can benefit tremendously from here on if we will only take the time and effort as shown by Colonel Shaw's analysis.

L. A. Holder

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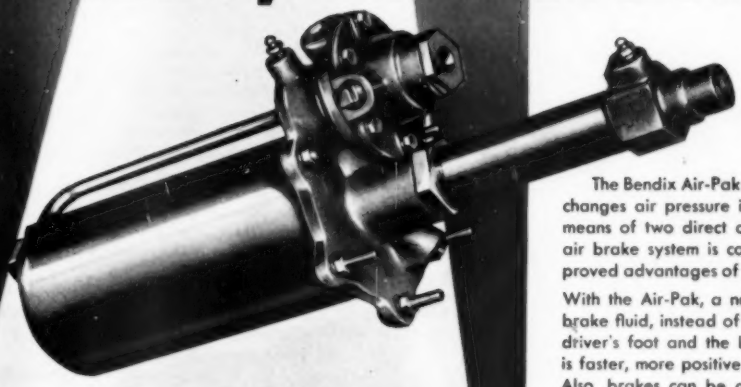

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Ever since our own Civil War, each major conflict has demanded the services of an ever-increasing proportion of the belligerent's manpower. Push-button warfare is not just around the corner. Wishful thinking to the contrary, we can at least for the next decade look forward to even greater demands on our manpower pool than ever before. Control of the sea lanes, of bases essential for delivering our atomic potential, and of land areas required to block the enemy from overrunning friendly industrial areas can be assured only through the use of military manpower. The complexity of modern weapons of war, the greatly increased expenditure of munitions of war, and the possibility of direct attacks on our homeland mean more rather than fewer men on the home front.

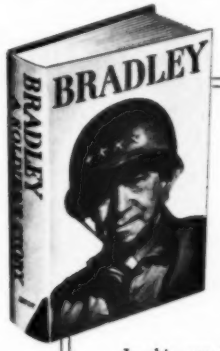
It is impossible at this time to forecast total requirements arithmetically. Too many imponderables are involved. We greatly underestimated our needs in World War II and any forecast today would only be as good as the assumptions upon which it was based.

However, to point up the problem, I shall briefly summarize World War II requirements. The total strength of the armed forces approximated 12,000,000 men and women. Replacements for casualties and losses due to other causes required another 2,000,000. Our total labor force, including the armed forces, reached 66 million in 1945. Of these some 7,000,000 were classed as additional workers such as teen-agers, retired people, and housewives. Industrial hours worked per week averaged 46.6. Labor turnover reached a rate of 87.2 in 1943. Even considering our increased population, our current employment rate plus the 9,000,000 fewer individuals in uniform brings us rather close to the bottom of that 1945 manpower barrel.

Conservation of manpower thus becomes of the utmost concern to all of us. Those who may represent the farm, the mine, heavy or light industry, public utilities or services, and we of the armed forces who may not always be too moderate in our demands—all of us, in uniform and out, must, as the demand increases, take whatever steps lie within our power to keep the bottom of the barrel out of sight. . . .

No nation lacking in either human or material resources can long support a major war. Hence raw and processed materials are also essential to our security. Actually, efforts to control the source of raw materials have in the past led to war.

Neither this Nation nor any other nation is completely self-sufficient in natural resources. The tremendous expansion in requirements for strategic and critical materials occasioned by World War II should serve as a warning and a guide to future action. Further, the continued development of strategic air power and its atomic potentialities is pointed directly at strategic materials either at their source or while being transported or processed.—GEN. JOSEPH T. MCNARNEY, U.S.A.F., *Office of the Secretary of Defense, before the Cleveland Advertising Club, Cleveland, Ohio.*



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The Riddle of MacArthur. By John Gunther. New York: Harper & Brothers. 231 pp. $2.75.

PARTS of this book appeared previously in *Look* magazine. All of it is the result of a visit to Japan—before the outbreak of the Korean War—by John Gunther, famed for his "Inside" volumes on the many complex subjects to which he has devoted his talents. Here he writes in his accustomed vein: reporting fact and fancy to please his wide audience. The writing is clear, concise, human, and at times entertaining.

The easiest of all clichés for a reviewer to grasp would be to say that this is John Gunther's "Inside MacArthur." Unfortunately, it is not. The genius of General MacArthur is missed, and it is obvious that to Mr. Gunther the General is still a riddle.

Those who have studied General MacArthur's brilliant military career in the cold light of achievement over the years will find the Gunther text unsatisfying for the simple reason that the author does not seem to know his military history. And in dealing with so vast a subject as the MacArthur record in the Pacific a knowledge of military history is essential. Mr. Gunther may have such knowledge. If so, he has unfortunately hidden it under the iconoclastic style so common these days.

Obviously, this book was written before General MacArthur's recall from Japan. A reading of it now serves to emphasize the stature of one of our greatest military leaders and the profound contribution General MacArthur has made to the welfare of our country in war and in peace. After reading Mr. Gunther's attempt to answer his self-imposed riddle, this reviewer—together with millions of his fellow citizens—regrets anew the shameful and unworthy manner in which General MacArthur's recall from Tokyo was accomplished. Rather the riddle is that our civilian and military leaders could have been parties to such crude proceedings.—LEO A. CODD.

Materials Handbook—Seventh Edition. By George S. Brady. New York: McGraw-Hill. 900 pp. $8.50.

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practical volume has been expanded to include almost 1,500 more materials than contained in the previous edition. It now supplies a wealth of facts and figures to simplify the estimating, specifying, and purchasing functions in product manufacturing and processing. George S. Brady, the author (a frequent contributor to ORDNANCE), has regularly revised and enlarged this reference volume as an outgrowth of his varied experiences in industry and government.

Part I of the "Materials Handbook" gives the pertinent physical and chemical properties of materials, describes substitute and alternate materials, and includes numerous examples of just how these materials are used. It also covers certain processed materials which constitute the raw materials of some industries.

Part II contains numerous charts, maps, and tables on the world distribution and production of the materials of industry, accompanied by authoritative interpretations and analyses. It is designed to provide economic-geographic information that is essential background for industry's intelligent, effective planning for and designing and purchasing of the materials it uses.—ROBERT EMSWORTH.

Appeal to Arms: A Military History of the American Revolution. By Willard M. Wallace. New York: Harper & Brothers. 308 pp. $4.50.

IN considering how the Thirteen Colonies won their independence in the American Revolution, the perspective of the years emphasizes one important element: during the past two centuries, the foundry, the mill, and the factory have increasingly influenced the outcome of war. Rarely has the combatant with inferior industrial resources been victorious.

True, the long line of communications across the Atlantic was a severe handicap to the British. Nevertheless the American victory is a valuable study in the military history of our country even in the Atomic Age.

The enduring factors are there if the author has the perspicacity and the ability to dig them out. Mr. Wallace has both in abundance. Furthermore, his writing is entertaining and highly readable. The author soft-pedals tactical details that are ephemeral. His interest lies where the Revolution can be most profitable to posterity; *i.e.*, in strategy, in the qualities and defects of leaders on both sides, in the importance of morale and the will to win, in the human characteristics of the American citizen-soldier in combat.

Mr. Wallace has illustrated many campaigns with excellent maps. His work is scholarly and accurate and provides in a small, compact volume a comprehensive view of the land warfare of the Revolution in its essential aspects.—DONALD ARMSTRONG.

Mechanical Measurements by Electrical Methods. By Howard C. Roberts. Pittsburgh: Instruments Publishing Company. 357 pp. $4.

THIS is the second edition of a handbook that is most useful, not only for laboratories, but also for any production plant where accurate methods of measurement are needed for difficult situations.

A feature of the book is that it brings together for the first time in one volume clear and concise descriptions of the important known methods for taking physical measurements by inductance, capacitance, resistance, thermosensitivity, photostatic gaging, and acoustical methods. The author warns that the science has not been fully developed and that some of the methods are open to improvement. The book thus serves as a guide for those who desire to study and improve methods as well as for practical application.

It is difficult and sometimes impossible to make lineal measurements by physical means where only one surface is exposed, or to measure stresses and other factors in complete structures. The book, therefore, is a valuable addition to the library of any one working on the physical properties of materials.—GEORGE S. BRADY.

Ordnance Production Methods. Edited by Charles O. Herb. The Industrial Press. 542 pages; over 1,000 illustrations. $10.

ESPECIALLY in war's early stages, when producers are turning from the arts of peace to the manufacture of ordnance matériel, there is a clamor for information on know-how. In anticipation of this demand the editor has thoughtfully selected and arranged in this volume the contributions of *Machinery* magazine over more than a decade to the production of lethal weapons. There are articles here on the manufacture of small-arms ammunition, shells, fuzes, bombs, rockets, torpedoes, guns, and tanks—truly an imposing array.

This work is no more—and certainly no less—than it advertises itself. It does not pretend to offer critical analyses of the techniques described nor make comparisons among them. It is a first-class job of reporting, supported by excellent illustrations, the reader being permitted to arrive at his own conclusions.

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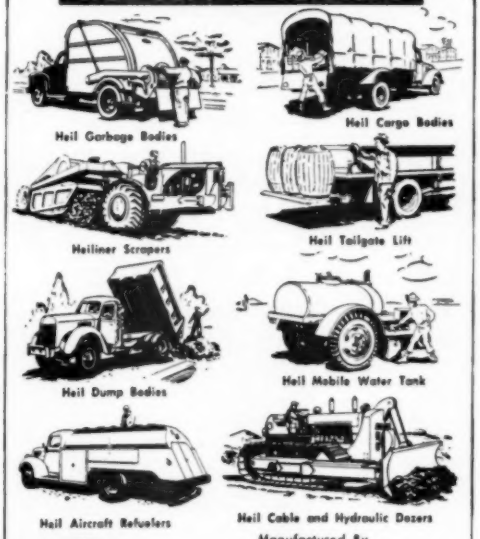

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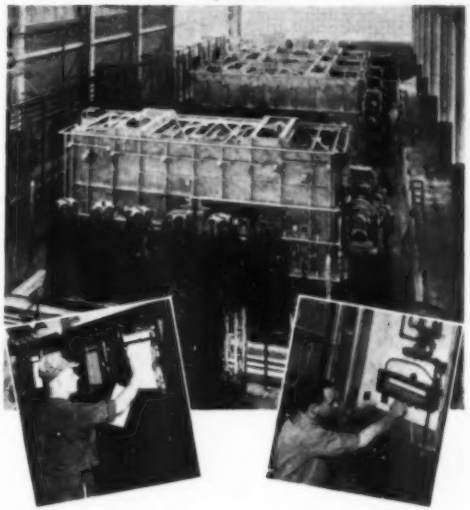

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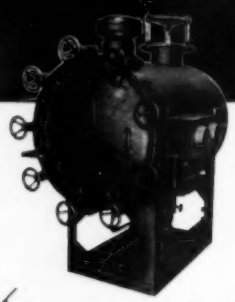

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Book Reviews

not only a place in war industry but also, perhaps, in the schools and other centers where youth is being trained.—ARTHUR F. MACCONOCHIE.

The Soldier's Load and the Mobility of a Nation. Col. S. L. A. Marshall. Washington: The Combat Forces Press. 122 pp. $1.

THIS small volume consists of a series of informative articles which have appeared previously in the *Infantry Journal* and the *Combat Forces Journal*. The theme is the unrealistic load which the soldier has to carry in combat, the absence of sound reasons for much of it, and the recalling of numerous factual incidents pointing out that something could well be done about it. Much of the matter is repetitious—the result of unedited compilation of articles on the same subject—but it is all interesting and convincing.

The requirement for excessive transportation, for special vehicles such as refrigeration and ice cream making trucks, with the attendant maintenance problem, is brought home forcibly. The case for the abolition of the bayonet is not proved, particularly in view of recent Korean happenings.—THOMAS K. VINCENT.

The Firearms Directory. Edited by Shelley Braverman. New York: The Firearms Directory. 149 pp. $15 (including revision service for calendar year—subsequent revision service, optional, at $4 a year).

THE Directory is incorporated within a 7-ring binder, eleven inches square, three inches thick (when filled), and approximately five pounds in weight. It is covered in maroon leatheroid, gold-stamped. It is designed to supply a compendium of firearms information for the use of ballistics laboratories, universities, libraries, police agencies, gunsmiths, firearms collectors, and "gunbugs." It may well do so eventually, but it certainly does not do so now. The "Books and Publications" section, for instance, contains simply an advertising notice of one single volume, sold by The Firearms Directory!

Only 16 pages of both text and illustration are allotted to rifles; 46 to pistols; 47 to firearms indentification; 10 to patents (covering only the Maxim firearms silencer); 30 to miscellaneous subjects. These latter are most interesting, especially the digest of pistol laws of all States, but nothing is covered fully. The subjects as specified above cannot be even "approached" in the allotted space, and the only information to reach this reviewer, which would permit even a guess as to what may be forthcoming, is that approximately forty pages, or inserts, will constitute each quarterly supplement.—F. W. FOSTER GLEASON.

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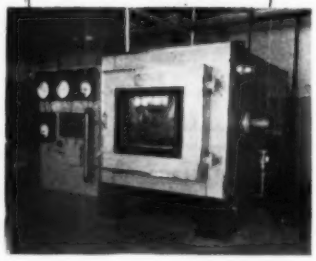

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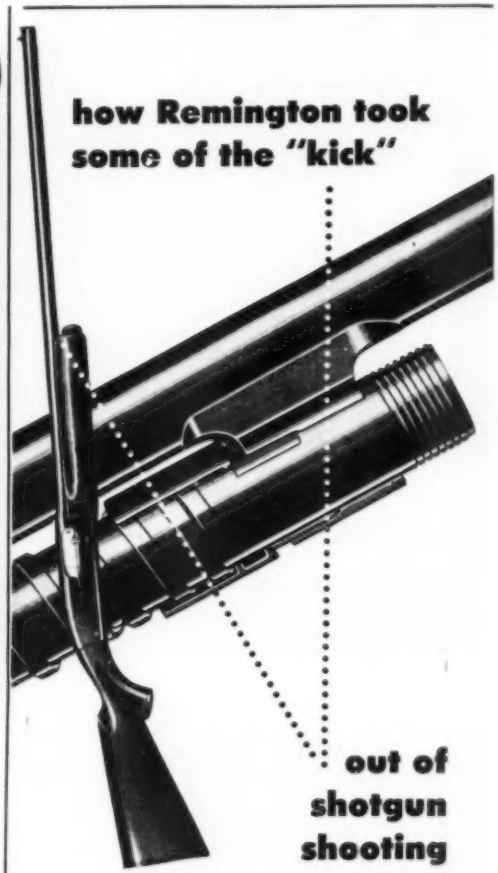

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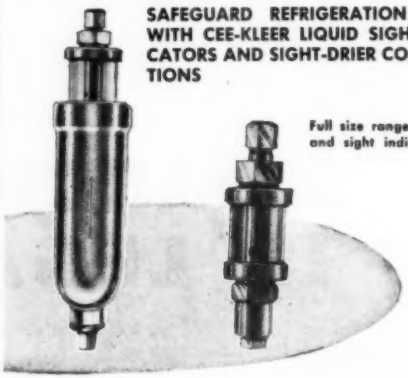

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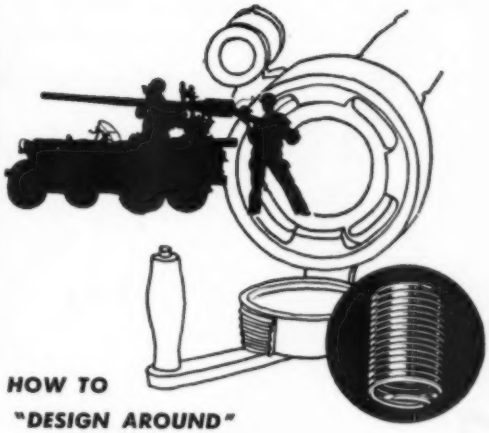

HOW TO "DESIGN AROUND" SCREW THREAD PROBLEMS

Ordnance engineers can easily "design around" screw thread troubles and eliminate field service repair by incorporating Heli-Coil stainless steel wire inserts into the original design. These precision-formed wire inserts add strength to tapped threads . . . prevent abrasion, corrosion, seizure . . . permanently protect threads against wear or stripping.

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Available in all popular thread sizes of National Coarse and National Fine Series; also spark plug and pipe thread sizes, Heli-Coil inserts are easily installed by any mechanic.

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Please send me ☐ Bulletin 650R on Design Data
☐ Bulletin 349 on Salvage and Service

NAME.....
FIRM.....
STREET.....
CITY.....ZONE.....STATE.....

*Name of manufacturer will be furnished on request

This loud-mouthed automatic fire whistle can be heard for a quarter mile

HERE'S one of the most unusual and foolproof fire protection devices ever made.* There are no wires, batteries or bells. Just a whistle attached to a high pressure cylinder filled with CO_2. When the temperature exceeds a pre-set limit, the compressed CO_2 is released into the whistle stem. The piercing blast can be heard for a quarter mile.

Tubing is an important part of this automatic fire signal, and both cylinder *and* whistle are made from Shelby Seamless Steel Tubing. Every cylinder undergoes a pressure test of 3,000 p.s.i. —and there has never been a failure in *8 years of use.*

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Let our service engineers work with you to obtain tubing that will fit your needs *exactly*. And make a note to write for Bulletin No. 17. Address National Tube Company, Frick Building, Pittsburgh 19, Pa.

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PITTSBURGH, PA.

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UNITED STATES STEEL

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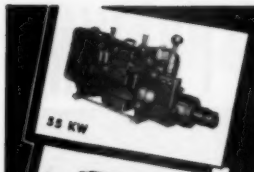

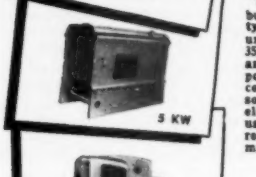

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FOR EVERY NEED!

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Send for a copy of "Case Histories"—a free booklet giving proof of Lamson "Know-How".

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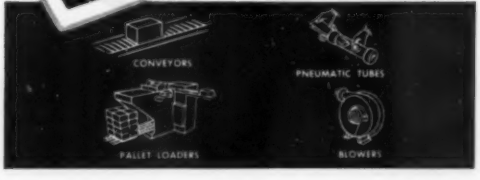

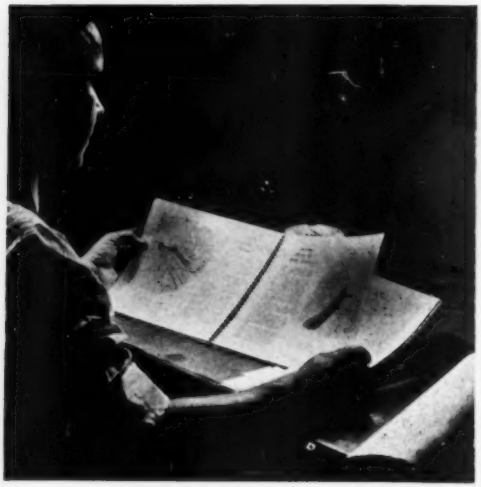

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The Fellows Gear Shaper Company stands ready with the skills and cumulative experience of a group of recognized authorities on gearing. Their field includes not only gears, but segments and special toothed-profiles for unusual purposes. Here gear-tooth design and the practicalities of high-precision manufacture are interrelated .... For Ordnance requirements, Fellows has equipped both arsenals and private suppliers' plants with complete equipment for producing precision gears, etc.

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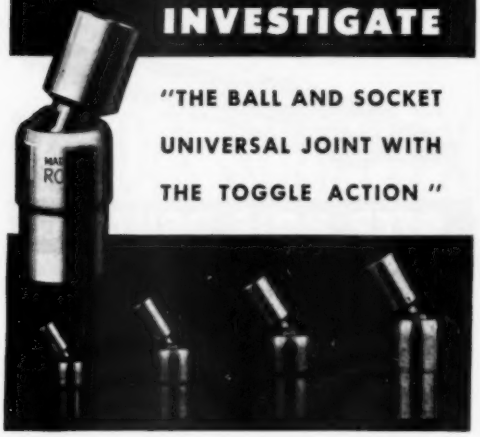

Hundreds of uses, continuous or intermittent operation low and high speeds.

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and the Parker Products which meet them

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JAN-C-490, Grade II	
Type 2	Parco Cleaners 341, 350, 371
Type 4	Parco Cleaners 250 and 260
Type 5	Parco Cleaners 210 and 220
Type 6	Parco Cleaners 100, 101, 110
JAN-L-548	Parco Compound—Parco Powder
U.S.A. 57-0-2	
Type II, Class A and Class A1	Parco Lubrite 1, 2, 3
Type II, Class B	Parco Compound—Parco Powder
Type II, Class C	Bonderite 32, 34, 100, 125, 140, 160, 170, 180
U.S.A. 50-60-1C	Bonderite 100, 125, 160, 170, 180
U.S.A. 3-213	
Type I	Parco Cleaner 250
Type II	Parco Cleaner 260
AXS 1245	(See JAN-C-490)
QQ-P-416 Type III	Bonderite 32, 34
Navy Aeronautical M-364	Parco Compound—Parco Powder

For information regarding other specifications write:

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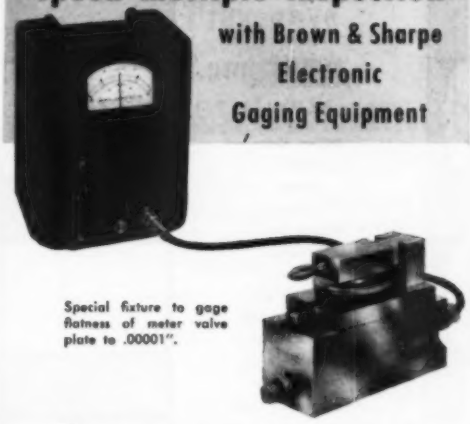
SPECIAL FIXTURES

speed multiple inspection with Brown & Sharpe Electronic Gaging Equipment



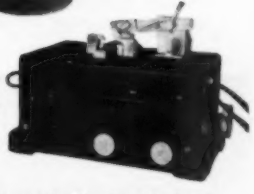
Special fixture to gage flatness of meter valve plate to .00001".

HERE'S how you can get faster, more accurate gaging for many kinds of small parts. Special gaging fixtures, custom-built by Brown & Sharpe, check all critical dimensions by .0001" to .00001".

Employing versatile Brown & Sharpe Gage Head Cartridges, these low-cost fixtures in combination with Brown & Sharpe Electronic Amplifiers provide flexibility that enables gaging right at the machine. Measurements are visually magnified from 1800 to 18,000 times.

Investigate Brown & Sharpe Electronic Gaging Equipment for your quality control. It can be applied for gaging thickness, length, angle, parallelism, diameter, taper or combinations of several dimensions. For details, write Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

Custom-made fixture simultaneously measures major and minor I.D.'s of tapered bores for taper accuracy.



Special fixture checks dimensions, side squareness, and side parallelism of cutter blades.

We urge buying through the Distributor

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● Designers, Engineers, Manufacturers of Production Equipment. Aetna works closely with the Army Ordnance Division in the production of ordnance materiel.

The Aetna-Standard Engineering Company

Youngstown, Ohio

A heavy "hour glass" worm gear shaft with deep hole extending its entire five-foot length.

DEEP HOLE DRILLING

A Complete Engineering and Manufacturing Service

The drilling and boring of deep holes, especially in the newly developed alloys (in many cases hardened before machining), is so vastly different from ordinary machine shop practice that few manufacturers realize the extent of the difficulties involved.

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Therefore, when your schedule calls for deep hole production, it will pay you to employ us, and have us review your requirements in relation to your facilities. The engineering fee charged by us for preliminary work has, in the past, never failed to substantially reduce the overall production cost.

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Through this we will not only arrive at the design of the tools best suited to drill and bore your deep holes economically and well, but also, and this is equally important, the correct procedure in making these tools work, including a detailed description of the machines and other facilities required, the exact power requirements, and a realistic estimate of the time the operation will consume.

In many cases, rather than have us furnish you with the tools for use in your plant, you will find it advantageous to have us do your deep hole drilling and boring for you in our own shop, under our own expert supervision.

For Deep Holes—Exclusively . . .
and for such machining operations where deep hole drilling is the dominant feature . . .

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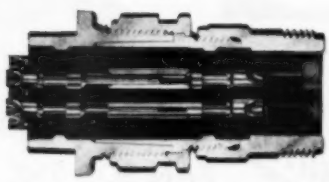

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High strength aluminum alloy . . . High resistance to corrosion . . . with surface finish.

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High current capacity . . . Low voltage drop.

SCINFLEX ONE-PIECE INSERT
High dielectric strength . . . High insulation resistance.

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- Moisture-proof
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- Single-piece Inserts
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- Light Weight
- High Insulation Resistance
- Easy Assembly and Disassembly
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- No additional solder required

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Whiz

Specification Corrosion Preventive Compounds for Government Contractors

Specification Number	Trade Name
MIL-C-972, Grade I (Superseding 52-C-18 Grade I)	Klad Kote 101
MIL-C-972, Grade II (Superseding 52-C-18 Grade II)	Klad Kote 122
MIL-C-6708, Type I (Superseding AN-C-52b Type I)	Klad Kote 102
MIL-C-6708, Type II (Superseding AN-C-52b Type II)	Klad Kote 252
AN-C-124a, Type I	Klad Kote 124
AN-C-124a, Type II	Klad Kote 224
AXS-673, Rev. 2	Klad Kote 103
AXS-1759, Grade I	Klad Kote 171
AXS-1759, Grade II	Klad Kote 172
AAF 14156, Amend. 1	Klad Kote 356
USA 2-122	Klad Kote 322
USA 2-121	Klad Kote 221
AN-VV-C-576b, Type I	Klad Kote 376
AN-VV-C-576b, Type II	Klad Kote 378
Light Bodied Slushing Compound (Excellent Water Displacing and Surface Active Qualities)	Klad Kote 365

PACKAGING ENGINEERS!

Newly Revised Klad Kote Reference Chart Now Available

Our newly revised Klad Kote chart, listing the latest specification numbers and specification requirements, will be sent you upon request. This chart includes the type of film, government specification number, product description, uses, application, removal, flash point, and protection requirements. It is an excellent reference for packaging engineers.

Most Klad Kotes are stocked for prompt delivery and are obtainable in 5 and 55 gallon containers. *Quotations furnished on request.*

Partial List of Additional Compounds of Which We Are an Approved Supplier:

Corrosion Preventive Compounds: Navy Dept. 52-C-17 (Int) Amend. 1 (14-C-6) Grades A, B, and C – U. S. Army 2-84B – U. S. Army 2-82C – Army Air Force AAF 3604-A.
Anti-Seize Compounds: MIL-C-5544 – JAN-A-669.
Aircraft Cleaning Compounds: Army Air Force AAF 20015-E – Navy Aero C-147.
Non-Inflammable Hydraulic Fluid: Navy BuAer MIL-F-7083
Protective Coating: Army Ordnance AXS-1756 – Navy Ordnance 52-C-41.
Paint Remover: Navy BuAer 52-R-15, Amend. 1.
Carbon Removal Compound: Army Air Force AAF X20043-A.

Write: INDUSTRIAL-AVIATION DIVISION

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HOW TO "Keep Your Powder Dry"

Shell canisters are exposed to the toughest elements. Dumped on beachheads during landing operations, or right in the "drink". To "keep your powder dry" use Seamless F.O.S., the industrial tape that seals *tight* and stays sealed. A strong, tenacious tape that seals against moisture and vapor —resists abrasion.

▸"ON DECK" SHIPMENTS

Protect Ordnance equipment against frozen gun bearings, corroded radio coils, rusted parts. Seal hatchways, raceways, exhaust ports with Seamless F.O.S. Industrial Tape. Made in rigid accordance with Specification JAN-P-127, Type 1, Grade B.

▸STENCILING INSIGNIA

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2. Our job as pioneer and *originator* of pressure sensitive industrial tape is to keep abreast of, and anticipate, the needs of the Armed Forces and industry.

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EXAMINE THIS F.O.S. TAPE CHECK LIST

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Reinforcing • Waterproofing • Insulating
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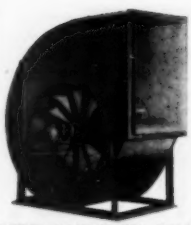
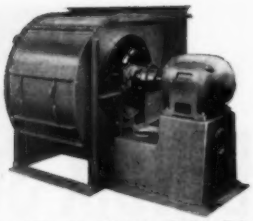
We will certify compliance with Specifications JAN-P-127 and AN-T-12a.

INDUSTRIAL TAPE DIVISION
THE SEAMLESS RUBBER COMPANY
NEW HAVEN 3, CONN., U. S. A.

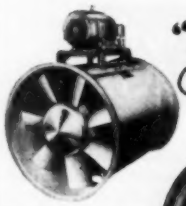


LIMIT-LOAD FANS.—For large-scale ventilation. Quiet, non-overloading. Sizes up to 500,000 c. f. m. Bulletin 3675.

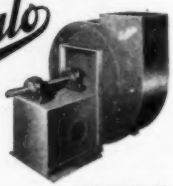


POWER PLANT FANS.—Primary, forced draft, induced draft —built for the severest service. Bulletin 3750.

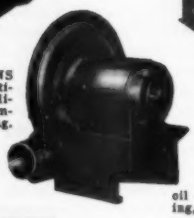
"Buffalo"



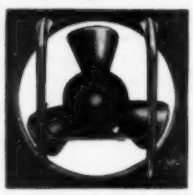
AXIAL FLOW FANS For light-duty ventilation and air conditioning service. Compact, non-overloading. Bulletin 3533-C.



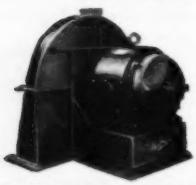
INDUSTRIAL EXHAUSTERS With interchangeable wheels for air exhausting or materials conveying. All-welded. Bulletin 3576.



"E" BLOWERS-EXHAUSTERS For oil or gas furnace blowing, line boosting, cleaning. Bulletin 3014-C.



BREEZO FANS.—Easy-to-install wall fans. Durable and very economical. 6 sizes. Bulletin 3222-F.



TYPE "CB" AND "C" PRESSURE BLOWERS.—In sizes for pressures up to 4 pounds and capacities up to 75,000 c. f. m. Bulletin 3553-A.

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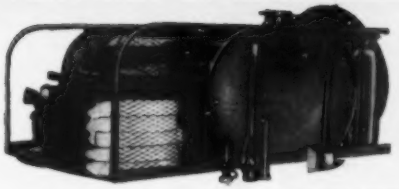

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INDEX TO ORDNANCE, VOLUME XXXV

The Index to Volume XXXV of ORDNANCE, with title page for binding, is now available. It will be sent free of charge upon request to the Editorial Offices at the address below. It covers subjects in the following 1950 and 1951 issues: July-August (No. 181), September-October (No. 182), November-December (No. 183), January-February (No. 184), March-April (No. 185), and May-June (No. 186). It is arranged alphabetically by subject and author.

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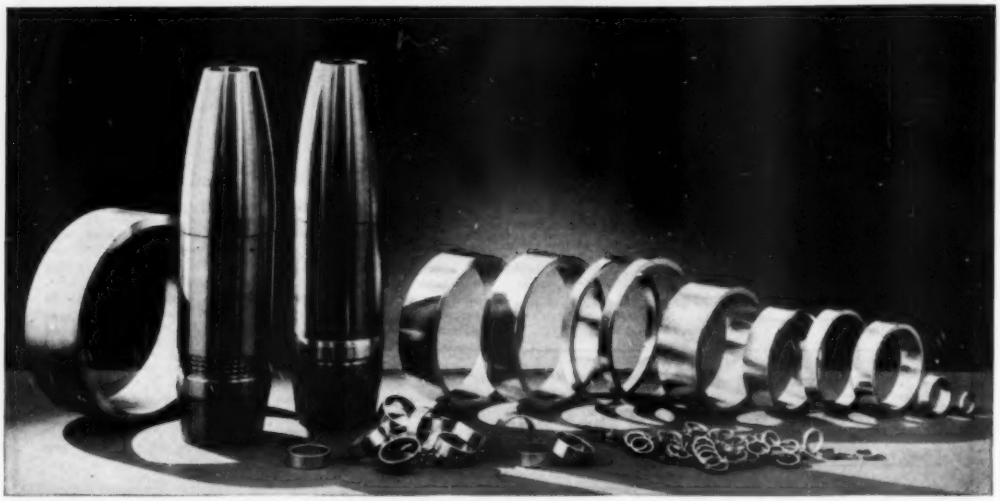

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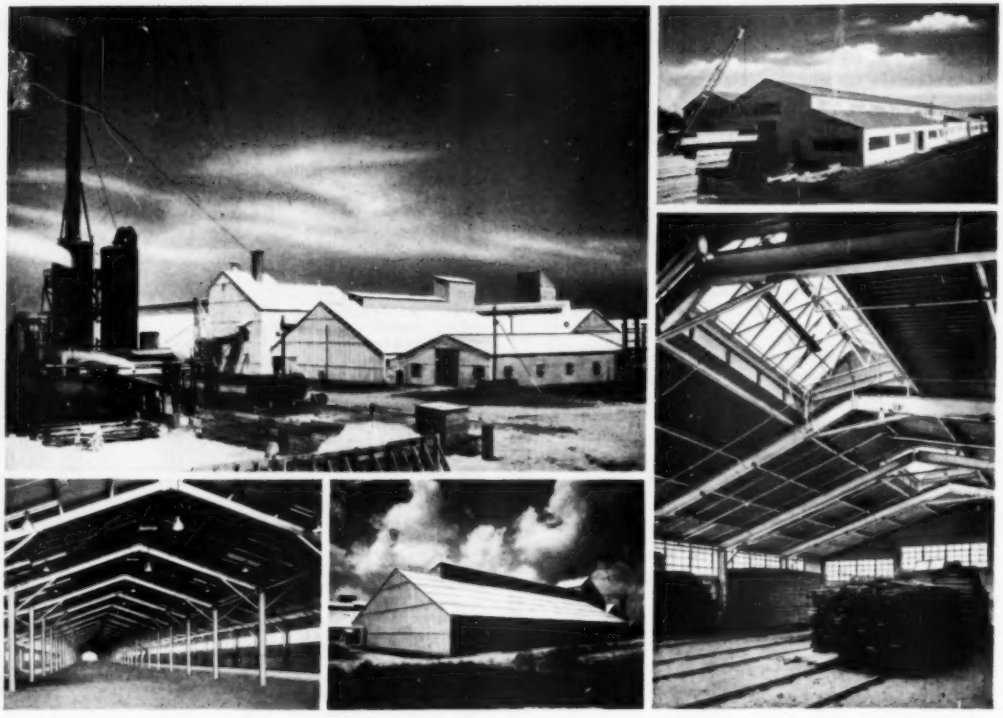

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ARMAMENT TECHNOLOGY

This section of ORDNANCE contains articles of a detailed and technical nature on ordnance research, development, manufacture, field use, and related subjects.

Communications Zone Ordnance

An Important Link in the Chain of Supply Operations

by

Lieut. Col. John W. Schroder

Picatinny Arsenal, Dover, N. J.

A breakdown of Ordnance service in the communications zone may spell the difference between victory and defeat

ONE of the least publicized but one of the most important links in the chain of Ordnance service in the support of Army operations is the Ordnance service in a communications zone. It is here that Ordnance operations really become big business. The magnitude of the communications-zone operations may be better visualized when it is realized that all the supplies required for the support of the troops in the theater normally pass through the communications zone and that many services are performed there.

100,000 Tons a Month

For each million men in the Army in the theater, an average of one hundred thousand tons of Ordnance supplies must be received each month in addition to initial equipment shipped in with the troops.

In discussing the Ordnance organization and operation in a communications zone, it is impossible to point to a standard setup since the requirements, and the organization to fulfill the requirements, will vary from one communications zone to another. In order properly to understand the Ordnance organization and functions in a communications zone, it is well to take a look at the organization and functions of the communications zone itself.

Area of the Zone

The area of the communications zone includes all the territory of the theater of operations between the rear boundary of the theater and the rear boundary of the combat zone. It must be large enough to provide for the proper operations and defense of the supply, evacuation, transportation, and service functions required in the communications zone for rendering support to the combat zone. The forward boundary of the communications zone should be as far forward as the conduct of operations will permit in order to give the best support to the combat zone.

The area organization of the communications zone will depend upon the conditions in a specific theater. Under circumstances which make it practicable, an undivided communications zone is best because of the simplicity of operation. However, if the area is extensive, it must be divided into sections in order to decentralize the control of operations properly.

Zone Sections

A diagram of a divided communications zone consisting of an advance, an intermediate, and two base sections is shown in Figure 1. The number and arrangement of sections will depend upon many factors—including the terrain, railway and highway networks, and scheme of maneuver.

The primary purpose of designating a communications zone is to relieve the combat commanders of the responsibility for logistical and territorial operations not required in the immedi-

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ate conduct of combat operations. The communications-zone commander is responsible to the theater army commander for full administrative support of all army units located in the theater and such administrative support to other forces as may be directed.

Command Organization

The command organization and the position of the Ordnance officers in that organization are shown in Figure 2. The organization of the Ordnance operations in a communications zone follows the same pattern as the organization in the communications zone itself. Within each section, and within the communications zone as a whole, an organization must be set up to perform the Ordnance mission. Briefly stated, this mission is the procurement, receipt, storage, issue or shipment, and maintenance of all Ordnance equipment and supplies.

The Ordnance Officer on the staff of the section or communications-zone commander is responsible for carrying out the Ordnance mission and has operational control of Ordnance units assigned to that headquarters for this purpose. The number and type of units assigned for this purpose will vary, depending upon the nature and magnitude of the troops supported and also the area in which the operations are being conducted.

Most of the Ordnance operations and installations are assigned to the communications-zone sections for command and control. Only those activities which

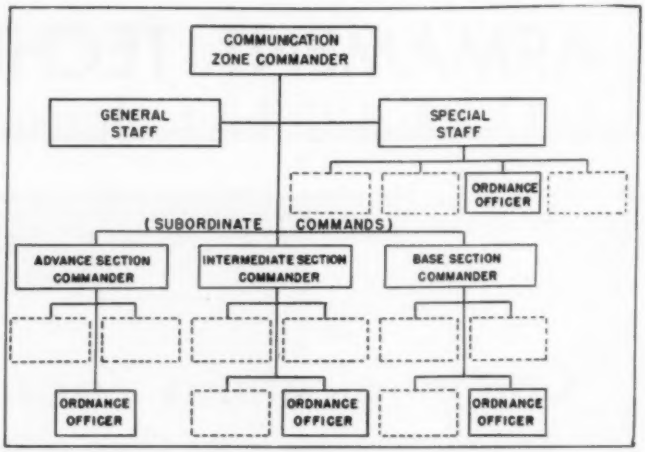

Fig. 2. Typical command organization in a communications zone.

are intersectional or of a special nature will be retained under the direct control of the communications-zone Ordnance Officer. Nevertheless he is responsible for the over-all Ordnance planning, policies, procedures, and the procurement and allocation of means to the various communications-zone sections to carry out their Ordnance mission.

Special Companies

With the exception of the automotive and armament-rebuild battalions, Ordnance service in the communications zone is performed by specialized companies grouped as required under battalion and group headquarters. This affords the maximum flexibility.

Figure 3 indicates the Ordnance units most commonly found in the communications zone, and the principal function for which each is responsible. The number of each required will depend upon the troop strength supported, the nature of the operation, the terrain over which operations are to be conducted, the nature of enemy opposition, and any other factors which may affect the consumption of Ordnance supplies.

The Ordnance service troops in the communications zone may be organized either functionally or on an area basis. Experience has shown that it is better to separate the organization for the handling of ammunition from that for Class II and IV items (general Ordnance supplies) because of the peculiar nature of the operation.

The Best Method

On the other hand, it has been found that generally the combination of supply and maintenance for Class II and IV items into a single over-all organization is the best method. Such a combination insures that the maintenance operations will react promptly to changes in supply requirements. Thus, depot maintenance production may be utilized to meet the more urgent supply demands, and at the same time it insures an adequate supply of parts to sustain maintenance operations at a maximum rate.

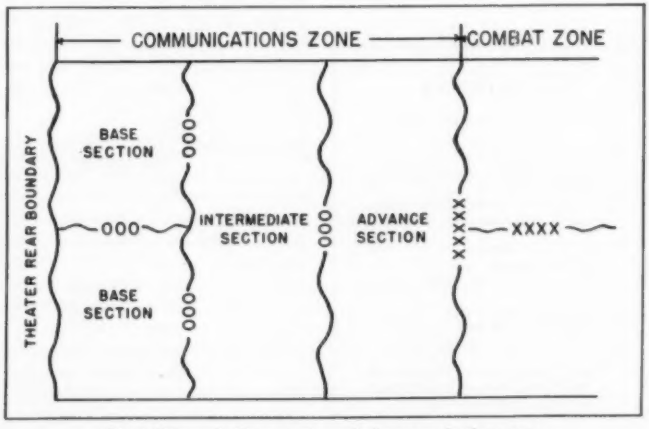

Fig. 1. Schematic diagram of a typical communications zone.

UNITS	FUNCTIONS														
	COMD, ADM, AND TRAINING	TECH SUPERVISION	FLD MAINT	DEPOT MAINT	TIRE REP	EQUIP ASSEMBLY	SUP - CLS II & IV	SUP - CL V	EVAC OF EQUIP	AM RENOVATION	BOMB DISPOSAL	BALLISTICS SV	DELIVERY OF VEHS	OPERATE COLLECTING POINT	
HQ & HQ DET, ORD GP	X	X													
HQ & HQ DET, ORD BN	X	X													
ORD AM DEPOT CO								X							
ORD FIELD MAINT CO		X	X												
ORD ARMAMENT REBUILD BN	X	X		X											
ORD AUTO REBUILD BN	X	X		X											
ORD MTR VEH DISTR CO									X				X		
ORD TIRE REP CO		X			X										
ORD MTR VEH ASSEMBLY CO		X				X									
ORD SUPPLY DEPOT CO							X								
EXPLOSIVE ORD DISPOSAL SQD											X				
AM RENOVATION TEAM		X								X					
BALLISTIC & TECH SV TEAM		X										X			
ORD COLLECTING POINT CO														X	
ORD PARK CO							X								

Fig. 3. Ordnance units normally found in a communications zone.

Ordnance troops are not the only source of manpower for carrying out the Ordnance mission in the communications zone. Civilians or prisoners of war should be utilized to the maximum possible extent in order to reduce the number of U. S. troops required. The same thing holds true in the utilization of local facilities and resources.

Use of Civilians

Europe was by no means the only place where civilians played an important part in performing communications-zone functions. It was also very true in other parts of the world, such as India and Australia. In many cases the work was performed by contract with existing civilian agencies rather than by hiring the individual personnel.

For example, in Australia the Australian branch of General Motors Corporation handled the receipt, storage, and issue of automotive spare parts by contract, using their well-established organization for this purpose. This organization also installed and operated American equipment for the rebuilding of automobile engines for the U. S. Army.

The Ordnance functions performed in a communications zone are similar to those performed in a combat zone, and in many cases are exactly the same. The greatest difference lies in the greater stability and lesser mobility of the operations in the communications zone. The installations are generally larger, and the amount of direct support furnished to troops in the area constitutes a smaller portion of the over-all operations.

In addition to the normal supply and maintenance support given directly to troops, as in the combat zones, the following functions are found in the communications zone which are not normally found in the combat zone: first, the receipt of supplies from the zone of interior and the initial assembly or processing of much of the equipment; secondly, the storage of large amounts of reserve supplies; thirdly, the performance of depot maintenance for return of supplies to depot stock.

Operations Complex

Operations are thus more complex than those in the combat zone and are greater in volume. The degree of stability and mobility will vary within the communications zone itself. Most of the operations in the advance section of the communications zone are of the mobile type, since they must keep up with the movement of the armies being supported.

The ammunition supply installations in a communications zone will consist of a series of ammunition depots, echeloned in depth to provide adequate storage for the reserve supply of ammunition as well as flexibility. The first of these depots is in the general vicinity of the ports of entry to the theater in order that they may receive incoming shipments and identify them as soon as possible.

The most forward of these depots are in the advance section so as to be conveniently located for forwarding ammunition to the combat zone as required. Between these lie such intermediate depots as the situation may require.

While the normal flow of ammunition may be considered to be from base to intermediate to advance depot, and then to the army depot, it is not unusual for ammunition to go directly from the base depot to an army depot to save rehandling.

A portion of the ammunition received in any ammunition depot will be unserviceable due to improper handling or exposure to the elements. The inspection and repair of this ammunition, and such modification of ammunition as may be approved, is supervised by specially trained personnel of the ammunition-renovation team attached to the communications-zone ammunition depots. Very little of this work is accomplished in the combat zone due to the more temporary nature of the installations located there.

General Supply

The organization for handling the Ordnance general supply functions parallels the ammunition-supply organization. The installations consist of a series of depots, starting in the vicinity of the ports of debarkation and extending to the forward area of the communications zone. These depots may be an Ordnance branch depot or the Ordnance section of a general depot containing depot operations of two or more technical services. If the theater of operations is wide enough to justify it, the depots will also be echeloned in breadth to give flexibility and make maximum use of available transportation facilities.

Newly arrived matériel will first go from the port to a base depot where it is identified, picked up on the stock records, and stored until required for shipment forward. When required, the matériel will be shipped forward through the series of depots to the army depot. As in the case of ammunition, these shipments may by-pass one or more of the communications-zone depots in going forward to the army depot to reduce handling and transportation requirements.

The stocking of each item in each depot gives the maximum flexibility

and protection against loss. However, this is not always practical. Some items, such as certain fire-control equipment, will be in such short supply that it is necessary to store them in a limited number of locations, often only one, in order to insure a proper supply of these items when required.

When the item is stored in only one depot, that depot is designated as a "key depot" for the particular item. A depot may be a key depot for one or more items and at the same time have the normal mission of being an Ordnance general supply depot for other Ordnance matériel.

Park Operation

Because of the large area needed and the special handling required for vehicles and artillery pieces they are normally stored in a separate installation known as a vehicle and artillery park. Such a park may be operated by a battalion consisting of an Ordnance park company, a motor vehicle assembly company, a distribution company, and a field-maintenance company.

Since many of the vehicles and artillery pieces are shipped to the theater in a knocked-down and crated condition to save shipping space, it is necessary for the motor vehicle assembly company to assemble and service them before they are issued. In addition to the initial assembly and servicing, vehicles and artillery pieces require a considerable amount of servicing while in storage.

The movement of the vehicles and artillery pieces forwarded for storage in other parks is accomplished by the drivers of the distribution company. On the return trip the members of this company bring back matériel which is in need of repair or salvage.

In order to insure the best distribution of available supplies, and to provide a basis for requisitioning replacement supplies from the zone of interior, it is necessary to establish a theater central stock control system. The Ordnance Officer of the communications zone is responsible, under the control of the communications-zone commander, for the operation of the Ordnance section of the theater central stock control point.

This section is responsible for maintaining the necessary records and taking the necessary action to maintain the theater Ordnance stocks in accordance with prescribed supply levels, for making proper distribution of stocks within the theater, for exercising special control over critical items, and must be the source of information regarding supply status and consumption.

In addition to the central stock-control section, it is essential that an adequate stock-control system be established in each depot and as required in the headquarters of the communications-zone sections.

The scope of maintenance in the communications zone includes the complete range of maintenance activities. Organizational maintenance must be performed by the using units in the communications zone the same as in the combat zone. Field maintenance for the Ordnance equipment in the hands of using units in the communications zone is a responsibility of the Ordnance Corps in the communications zone.

Ordnance is also responsible for performing depot maintenance on all Ordnance equipment in the hands of army troops in the theater, together with such equipment in the hands of the Air Force and the Navy as may be directed.

The difference in the nature of these two maintenance missions makes it desirable to organize differently for the two. The field maintenance is performed by Ordnance maintenance companies grouped together in battalions.

Responsibility

Each battalion is assigned the responsibility for maintenance and parts supply to all troops in a specified area. As using units move from one area to another, the responsibility for their support shifts to the appropriate battalion. This method of organization insures adequate maintenance support for all units.

Most of the pieces of equipment repaired by the field-maintenance units are returned directly to the using units from which they were received. Depot maintenance, on the other hand, includes major repair and complete rebuild of equipment for return to depot stock.

Most of this work is done by the automotive-rebuild battalion, the armament-rebuild battalion, and the tire-repair company, all of which are organized and equipped for extensive work in their respective fields. The two rebuild battalions contain specialized companies, on a balanced basis, and should be used as complete battalions and not as independent companies.

By improvement or development of equipment within the theater, the maintenance organizations, especially the depot-maintenance shops with their limited manufacturing capacity, can provide items of equipment which cannot be obtained through normal supply channels in the time required.

Collecting points are established on the axis of supply, near the centers of operations, to receive, inspect, classify, and segregate equipment and to effect disposition of it to maintenance, supply, or scrap facilities. The bulk of the equipment received by these collecting points comes through maintenance channels or is overflow from collecting points in the combat zone and is generally unserviceable.

Important Factors

No fixed pattern can be established for the location of Ordnance service units or installations in the communications zone, but it is well to consider some of the factors which must be considered when selecting such locations. The first, and perhaps the controlling factor, is the over-all transportation system. This includes rail, highway, air, and water, and the installations must be so located that they can handle the supplies brought in by the transportation system and utilize it economically for outgoing shipments.

The nature of the terrain is also important, since the installations require a good deal of hardstand, a good internal road net, and either existing covered space for shops and storage or an adequate area for its erection.

This short description of Ordnance operations in the communications zone does not cover the many details that an officer receiving an assignment in this area will need to know—but it should give him an appreciation of the magnitude of the organization he is entering and the importance of its activities. A breakdown of Ordnance service here results in a breakdown all along the line to the fighting troops—and may spell the difference between victory and defeat.

(This article reflects the opinions of the author and not necessarily those of the Ordnance Corps.)

Army photo

The U. S. Carbine

How American Industry Helped Develop the Light Weapon

L. A. Carten

BETWEEN World War I and World War II the rifle, pistol, and bayonet were the personal weapons of the American fighting man. The infantry soldier had his rifle and bayonet. His leaders carried pistols. If a soldier's assigned task made it undesirable to encumber him with a rifle, he was issued a pistol. As the number of team-operated weapons—machine guns, mortars, antitank guns—increased in the Infantry division, the demand for a weapon weighing much less than the rifle and reaching out much farther than the pistol grew more insistent.

No Safe Area

Early in World War II the bold, aggressive tactics of the German parachutists and armored units made it doubly clear that in modern war there is no rear area safe from attack by the soldiers of the enemy; that maintenance, supply, and communications troops must be better equipped to defend themselves against sudden attack than they were in the American armed forces at that time.

Therefore the Chiefs of Infantry, Cavalry, and Field Artillery asked that a short, lightweight rifle be developed immediately. So in late August 1940 the Chief of Ordnance was given the job of coming up with a good 5-pound carbine or light rifle effective up to 300 yards.

New Cartridge

A cartridge for the new weapon was designed and developed in collaboration with the Winchester Repeating Arms Company. This was done after careful analysis of available cartridges showed that existing types were unsuitable. Needless to say, the experience of Winchester in the development of ammunition gave Army Ordnance the benefit of a reservoir of very appropriate technical skill on which to draw. The job took about six months. The resulting cartridge resembles the caliber .32 Winchester self-loading (Fig. 2).

Colonel Carten, Ordnance Reserve, U. S. Army, is chief of the Weapons Section, Small Arms Branch, Industrial Division, Office of the Chief of Ordnance, Washington, D. C.

Concurrently with cartridge development, sources of rifle design talent were circularized. In response to this invitation the following submitted light rifles for test: Auto-Ordnance Corporation, Colt's Patent Fire Arms Company, Harrington & Richardson Arms Company, George J. Hyde (first sponsored by Bendix Aviation Corporation and later sponsored by the Inland Manufacturing Division of General Motors Corporation), Savage Arms Corporation, Springfield Armory, Russell J. Turner, Winchester Repeating Arms Company, and the Woodhull Corporation.

Winchester Successful

The models submitted represented design efforts of outstanding merit. The successful model was the Winchester rifle, which was adopted after careful study and test in October 1941 with certain minor modifications as the Carbine, Caliber .30, M1.

Fig. 1 shows the M1 carbine equipped with the bayonet-knife M4

Fig. 1. The M1 carbine equipped with bayonet-knife M4.

which was developed for it. The oiler for the carbine can be seen in the recess in the stock with the end of the sling looped around it. The magazine holds fifteen cartridges.

Cycle of Operation

The operation of the carbine is very interesting. The power for actuating the mechanism is delivered by the piston located on the underside of the barrel. The gas cylinder in which the piston moves is part of the barrel. The gas port in the barrel is both entrance and exit for the gases which press against the gas piston, as there is no gas port exterior to the bore of the barrel.

When a shot is fired, powder gases enter the gas cylinder as the bullet passes the port and impinge upon the piston, which travels about 5/32-inch in transmitting necessary energy to the operating slide to rotate the bolt (Fig. 4), compress the operating-slide spring, and do other necessary work. This compact piston arrangement was the contribution of David M. Williams, the well-known inventor, who also designed the actuating system used in the Colt Ace pistol which gives caliber .45 pistol training with caliber .22 ammunition.

Nonexclusive License

The Government bought from Winchester a nonexclusive license to make carbines or rifles incorporating its patented features. The dominant patent cited in the license agreement Contract No. W-ORD-625 is U. S. Patent No. 2,090,656 issued on August 24, 1937, to David M. Williams.

The model that won the competitive test still had to be engineered for production. As a necessary preliminary, orders were given to the Inland Manufacturing Division of General Motors and the Winchester Repeating Arms Company for five toolroom models each for further tests. Work was started simultaneously on the preparation of drawings.

But the pressure to get carbines into

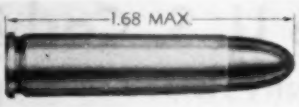

Fig. 2. Caliber .30 carbine cartridge.

the hands of troops was so great that production contracts were placed with Inland and Winchester in November 1941 before models were completed and finished drawings were ready. It was not until late in February 1942 that Inland received the first official Ordnance drawings and specifications.

Nevertheless, the division turned out its first production carbines in June 1942, a remarkable record made possible by the outstanding coöperation of the engineers of Inland, Winchester, and Army Ordnance and by the production skill of Inland.

In addition to Inland and Winchester, the M1 carbine was made by the Underwood-Elliott-Fisher Company (now the Underwood Corporation), Hartford, Conn.; the Saginaw Steering Gear Division of General Motors Corporation at Grand Rapids and Saginaw, Mich.; the Rock-Ola Manufacturing Company, and the Quality Hardware and Machine Corporation, Chicago, Ill.; the Rochester Defense Corporation (which combined interests of the National Postal Meter Company and the Todd Company), Rochester, N. Y.; the Standard Products Company, Port Clinton, Ohio; and the International Business Machines Corporation, Poughkeepsie, N. Y.

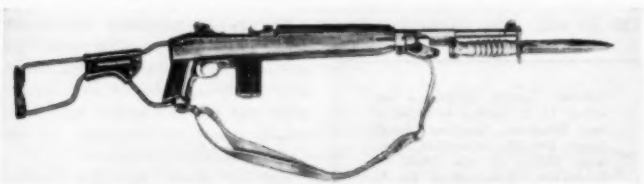

Fig. 3. Carbine M1A1 with folding stock for paratrooper use.

Problems Solved

Since the Inland Manufacturing Division was the first mass producer of carbines, it was the first to meet and overcome many problems of carbine production, the solutions to which it gave freely to other carbine manufacturers. At one time or another Army Ordnance arranged for the distribution, by Inland, of the following information to all interested manufacturers: process sheets for major components, tool, fixture, and manufacturing gage drawings, equipment specifications, and descriptions of heat-treating processes and associated specifications.

Every carbine manufacturer had access to the Inland plant at all times to see for himself just exactly how everything made there was processed.

Carbine production reached more than a half a million per month from ten plants run by nine different business organizations. Yet all carbines were repaired in the field with repair parts drawn from stocks made by all manufacturers and mingled under common stock numbers.

How was this possible? By scrupulous adherence to the Army Ordnance final inspection gaging standards and by frequent interchangeability tests in which parts of carbines made by all manufacturers were scrambled and reassembled into carbines which were required to function satisfactorily.

Gage Plan Tested

This practical test was a necessary check on the effectiveness of the final inspection-gage plan, since it was impractical to gage every dimension of every component. Here, too, Inland rendered valuable assistance to the Government by undertaking to procure the final inspection gages needed

by the inspectors of Army Ordnance at the carbine plants, each set comprising 462 different gage designs.

The administrative work involved in this gage program was extremely burdensome because the gage-making industry was filled to capacity at the time the program was started.

The story of how American industry came through with the tremendous quantities of carbines made in World War II is an interesting one and in the outcome a happy one for our country. Problems of design for mass production, of materials shortages, of integration of component capacity so that the maximum number of carbines were assembled by the carbine industry as a whole—these and many other problems were encountered and solved expeditiously.

Committee Formed

This record of accomplishment was made possible by effective coöperation between the members of the Industry-Ordnance team. Essentially this cooperation started at the conference table with frank discussion of mutual problems—and there were plenty of problems. To handle them quickly a committee, which became the Carbine Industry Integration Committee, was organized in March 1942.

The Carbine Industry Integration Committee had an outstanding record of coöperation in facilitating the production of the carbine. Like many of the other integration committees it was the successor of engineering and production committees formed by industry and Army Ordnance almost spontaneously to help produce badly needed fighting equipment faster.

Real Integration

It considered problems of drawings, gages, inspection materials, cleaning, packaging, integration of machine capacity, tool design, and any other matters related to making the best weapons as soon as possible. As a measure of the integration of the carbine manufacture it may be stated that 4,334,900 carbine components and 2,040,600 pounds of steel of various kinds were interchanged within the industry through the medium of the Carbine Integration Committee.

A word with respect to the subcontracting of carbine components will give some idea of the extent of the carbine-manufacturing program. An inverse measure of subcontracting is the count of components made by the prime contractors themselves. Of the 62 components in the M1 carbine, Quality Hardware and Machine Corporation made 2; International Business Machines Corporation, 2; Standard Products Company, 4; Inland Manufacturing Division, 4; National Postal Meter Company, 4; Rock-Ola Manufacturing Company, 13; Winchester Repeating Arms Company, 18; Underwood-Elliott-Fisher Company, 19; Saginaw Steering Gear Division, GMC, 24. Subcontractors in the carbine program were widespread—there were 1,600 of them.

> **"The use of highly mobile shock elements, of airborne units, and of parachute troops has made the details in the immediate rear of the firing line most vulnerable to enemy action. The pistol being relatively inefficient, these men have need of a better weapon capable of sustained accurate fire up to ranges of approximately 300 yards. It is obvious that such a gun must be as compact and as light as possible.**
>
> **"Of perhaps equal importance is the fact that soldiers armed only with the pistol are of no value to the offense when their normal mission has been suspended or completed. It is therefore desirable to equip these men with a weapon that will make them useful to the assault line during offensive action."—COL. RENÉ R. STUDLER, *now chief of the Small Arms Branch, Army Ordnance Research and Development Division, writing on the need for a new light rifle in the September-October 1941 issue of* ORDNANCE.**

Carbine development kept on all through the war. The M1A1 with folding stock (Fig. 3) was developed for paratrooper use. It is equipped with the bayonet-knife M4, which was developed later for all carbines. There are also a flash hider and a grenade launcher for use with the same grenades launched from rifles.

M2 Standardized

In October 1944 a carbine capable of selective semiautomatic or automatic fire was standardized as the M2—a modification of the M1 containing seven new components and five modified ones and having a 30-round magazine (see top of p. 151). In addition to its intermediate-range capabilities the carbine now has the short-range deadliness of the submachine gun—a versatile weapon, indeed.

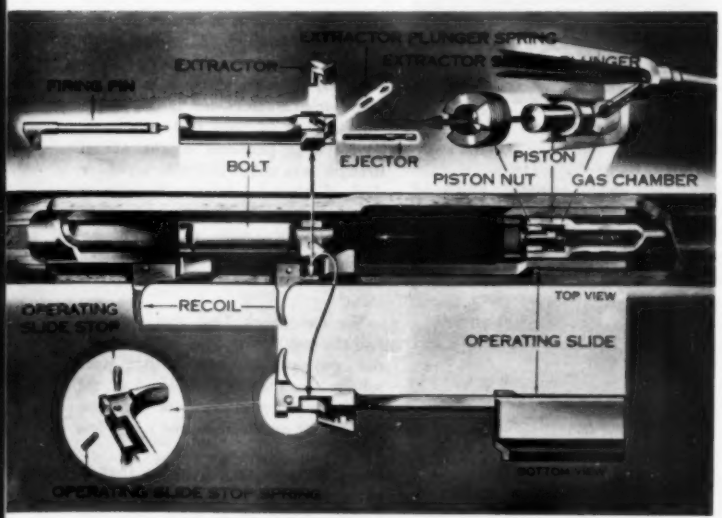

Fig. 4. Bolt and operating-slide assemblies of the M1 carbine.

The Lightning Group

A Proposed Fast-Moving, Hard-Hitting Combat Force

Joseph A. Reddy

NOW that the United States has assumed the rôle of global godfather and is committed to the defense of at least half the earth's surface, we must think about developing military formations which are capable of fighting successfully at any time and in almost any area in the world.

In such a situation the emphasis must lie primarily on the infantry—still the "Queen of Battles." But infantry can no longer go it alone. Artillery already has made great strides with its self-propelled 105-mm. howitzer battalions and its priceless air observation posts. The Quartermaster Corps has done a masterful job with new rations and new clothing. The Signal Corps has developed some excellent equipment, and Ordnance has produced, in the ¼-ton, ¾-ton, 2½-ton, and larger trucks, in new weapons, and in the new light tanks, the finest matériel ever issued to an army.

Shortcoming with Armor

The chief shortcoming appears to be with my own branch, Armor. Ever since Hitler's initial sweeps east through Poland and west through France and the glorious days of the "sand-table exercise" on the North African desert, armored commanders have envisioned themselves popped half out of a turret speeding across hill, dale, and enemy defenses in the 2-gun image of Generals Patton or Rommel.

In armored circles the emphasis has always been on the armored *unit*, whether a separate tank battalion, a full armored division or, as was once tried, an armored corps. Never has there been a serious effort made to synthesize a small unit, one with the rifle strength of infantry yet the spirit of cavalry; a unit whose rôle is like that of the famous "light infantry" of ages past—one which can be used to advantage in almost any terrain over which our troops will ever be called to fight.

I proposed just such a unit in 1942. Nine years later I was delighted to read that General Collins had authorized experiments looking to the formation of such elements in the Army's tables of organization.

Heavy Division Impractical

My original suggestion was made when the North African campaign was drawing to a close and Fortress Europa loomed ahead as the next theater. I felt that the Continent's "close" terrain made the old "heavy" armored divisions of two armored regiments and one infantry regiment impractical.

Prior to entering combat in Northern Europe, all but the 1st, 2nd, and 3rd Armored Divisions were streamlined to three tank battalions and three armored infantry battalions—but even this revision was not the complete answer.

Troops in jeeps would "find 'em."

The jeeps could mount the 105-mm. recoilless rifle in addition to machine guns.

European terrain left us no opportunity to fight as armored divisions. As far as I know there was only one genuine tank battle in the whole ETO—an engagement between the 2nd Armored and some German unit near Linnich in November 1944. Even that was more of an inconclusive slugging match than a genuine tank battle, which presupposes ability to maneuver. At the same time, with only seventy-eight riflemen in each of the division's nine companies of armored infantry, we lacked the strength to assault as ground troops with close and ample tank support.

Terrific Cost

Despite these conditions, the several armored divisions in the ETO gave a remarkably good account of themselves, but only at a terrific cost in men and matériel. My own 48th Armored Infantry Battalion, 7th Armored Division, sustained 116.6 per cent *battle* casualties during the period from August 10, 1944, to May 3, 1945. Twenty-four per cent of the official strength was either killed in action or died of wounds. After a little more than two weeks of combat, one medium tank company, with a table of organization complement of seventeen tanks, ordered its forty-second replacement!

We can thank God that America had the resources to stand such losses—but we can also ask if they were wholly justifiable and if, for the future, some other form of organization might not do the same job at less cost.

My personal suggestion, in 1942 as now, is to organize a "Lightning Group" made up of three battalions:

combat, motorized infantry, and light tank. They would be mounted in ¼-tons, 2½-tons, and light tanks, respectively. This would be a happy choice of vehicles because, based on experience and observation, I would say these three are the most rugged, versatile, and reliable that the Army possesses.

The ¼-ton truck, or jeep, needs no introduction. It and the 2½-ton truck probably did more to win the war than any other items of equipment.

Workhorse of the Army

The 2½-ton truck, with 6-wheel drive, is the workhorse and powerhouse of the Army. Unbelievably rugged, it has a comparatively low silhouette (without cab and canvas), tremendous reserve power, minimum noise, great speed, and is easy to handle. Until some one proves otherwise, I'll say it has cross-country mobility equal to or greater than the half-track.

The M24 light tank and its successors are all that any one could ask for in an army which traditionally calls for, and usually fails to get, mobility in its tanks. These vehicles are rugged, have the best American silhouettes, and, above all, can get up and go in terrain where the larger tanks are paralyzed. We were more afraid of the German Mark V Panther with its high-velocity 76-mm. gun than of the Mark VI Tigers and Royal Tigers with their 88's because, while either weapon would penetrate our armor, the Panther could go almost any place but the Tigers were comparatively road-bound.

The Tanker's Dream

The smallest high-velocity gun capable of piercing the enemy's average or typical armor, mounted on the lightest vehicle that will provide a stable mount, is the dream of every tank officer I know.

Officers with the greatest small-unit battle experience are the least likely to accept rear-echelon or training clichés

Motorized infantry in the mobile 2½-ton truck would be able to "fix 'em."

The new T41 Walker Bulldog light tank with 76-mm. gun could "finish 'em."

but, in general, the rôles of the combat, infantry, and tank battalions, respectively would be to "find 'em, fix 'em, finish 'em."

Make-up of the Group

A headquarters and three separate battalions would make up the hypothetic "Lightning Group." The headquarters would be small: a full-colonel commander, who would double as assistant chief of staff for armored affairs on the corps staff; a lieutenant colonel executive officer; a communications section; and one liaison section from each battalion.

In combat the group commander would consolidate his headquarters with that of the battalion having the best terrain location (or, frankly, the best mess) and use its intelligence operations and supply units as his own.

The combat battalion would have five companies: a combination headquarters and weapons company, three rifle companies, and a small service company. A German general once said that the only advantage of duty on the Eastern Front was that the intense cold prevented staff officers from doing their paper work.

Throughout the Lightning Group combat staffs would be kept small and mobile. Administrative personnel would be assigned to the service company, available when needed but out of the way when personal combat leadership is primary.

The Weapons Company

The weapons company would have six platoons: battalion headquarters, company headquarters and service, recoilless 75's, 4.2 mortars, caliber .50 machine guns, and antitank.

Each combat company would consist of a company headquarters and service platoon, a weapons platoon (three 75-mm. recoilless rifles, three 81-mm. mortars), and three combat platoons of five squads each (three combat squads, a heavy machine gun squad, and another armed with 3.5-inch bazookas).

The combat squads each would have twelve men and three jeeps. Each jeep would have a vehicular mounted caliber .30 heavy machine gun and a bipod caliber .30 light machine gun.

The infantry battalion would have a headquarters, weapons company, and service company identical with that of the combat battalion. (When you need heavy weapons, you want 'em there fast! Also, one of our greatest problems was the 57-mm. gun and half-track combination. By its nature, the gun had to be far forward, in muzzle defilade. But the bulk of its prime mover invariably gave the position away when moving in and precluded evacuation once contact had been made.)

The Rifle Companies

Each of the rifle companies would contain three rifle platoons and a weapons platoon, the latter similar to that of the combat company.

The rifle companies would have 117 riflemen in contrast with the 78 in an armored infantry "rifle" company, an increase of 50 per cent. In addition to three squads of 12 men, mounted in 2½-ton trucks, each rifle platoon would have a truck-mounted caliber .30 heavy machine gun section and a caliber .50 machine-gun section mounted in three jeeps, two with .50's and the third with a caliber .30 heavy.

The light-tank battalion would have a headquarters and headquarters com-

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The author served in combat for ten months with the 48th Armored Infantry Battalion of the 7th Armored Division in the European Theater and traveled over 2,200 miles with that outfit which sustained 116 per cent casualties. He was awarded the Combat Infantryman's Badge and a Bronze Star Medal with oak leaf cluster. He is now manager of the recreational development department of the New England Council, Boston, Mass.

pany, three tank companies, an assault-gun company, and a service company.

The organization of the tank battalion would differ somewhat from the separate battalions of World War II in that it would have integral infantry for close-in protection. Throughout training and combat this infantry would exchange places with the tank crews so that a man who is a tank crewman this week might serve in one of the jeep-transported security squads next week.

Eliminate Squabbles

This organization would eliminate the constant squabbles and misunderstandings that occurred when World War II infantry demanded tank support and the tankers cried for infantry protection.

The headquarters and headquarters company would have five platoons: battalion headquarters, company headquarters, assault guns, tank platoon, and an infantry platoon similar to the platoons of a combat company.

Each tank company would have a headquarters with a tank section and a combat squad and three platoons of five tanks and two combat squads each.

The assault-gun company would have a similar company headquarters and three platoons: two gun platoons of five howitzers and two combat squads, and an ammunition platoon with two ammunition squads and two combat squads for their convoy and security. This company might be used *en masse* to support a combined assault or might have a platoon assigned to either of the other battalions as needed.

The "Lightning Group" would be capable of doing so many jobs that its control should remain with a corps or higher commander who can see the entire combat picture and use the group where it can do the most good.

No "Suicide Element"

It should definitely *not* be used as a "suicide element" but rather as a group of trained experts who would be employed as the situation demands and then withdrawn to be used again when needed.

Chiefly, I think, the Group should serve with foot or motorized infantry as an independent part of a guard unit or as the means of protecting lines of communication and supply. It would be the ideal mobile reserve. It would have exceptional firepower, good cross-country mobility, and great speed. It would serve well as a harassing force for attachment to an infantry corps.

Equipped with its light weapons, the Lightning Group would be able to travel over rugged terrain and strike without warning where least expected.

Such a group would be the logical quick-striking unit, the flanker, for an infantry division. It would be useful in advance and as rear guards for infantry outfits.

Covering Force

Quickly brought up, it would be of great service in covering a retrograde movement. Its firepower and mobility would halt or delay almost any pursuit, dismounted or mechanized, long enough to give the main body time to reorganize. And even its combat companies are capable of covering a wide front in such a maneuver. An almost perfect mission would be distant reconnaissance to the front and flanks for a motorized or a foot infantry division.

With its great firepower it would be ideal for guarding advance supply and service installations. The tank battalion, its assault-gun company, and a rifle company could guard the actual base and the remaining units, combat battalion and the infantry battalion, less detachments, could guard the lines of communication and supply leading out from the dump.

Attached to an armored division, the "Lightning Group" would be useful in some situations as a "Combat Command D," striking hard and fast around an exposed flank at some rear depot or command post. It would be good to clear minor "islands of resistance." This unit would have everything—heavy weapons, infantry, and encircling power to accomplish this. It could be used also to establish "islands of resistance" because of its heavy weapons and its ability to fight its way out and vanish speedily should the holding become too difficult.

The 3.5-inch bazooka could destroy any hostile tank or enemy strongpoint.

In the event of a penetration, a "Lightning Group" could strike either directly at the junction of the penetra-

The powerful 81-mm. mortar would prove equally effective on offense or defense.

tion and our lines, thereby preventing the passage of more enemy (supplying fresh infantry, considerable antitank weapon strength and getting it all there *fast*), or it could fan out before an advancing penetration, thereby splitting the enemy and permitting him to be destroyed in detail.

Excellent Convoy

The combat company, besides being potential tank hunters, would be excellent against tank-destroyer units. The number of its antiaircraft weapons is so great that it also would be good for convoying trains.

The "Lightning Group" would be excellent as a means for patrolling conquered areas and for holding a beachhead or supply port where a landing has been forced by stronger units which have moved on. Equipped with a sufficient number of ¼-ton amphibians it would be good for operations in the Low Countries where frequent stream crossings must be made.

For much Asiatic employment (India, Burma, Southern China) the "Lightning Group" would be the only practical mechanized unit.

Special task forces are constantly needed during combat and are always a nuisance to the commander charged with organizing them. Ordinarily they weaken the major units from which their elements are taken, and they present innumerable problems of command, integration, coördination, and supply.

Has Many Rôles

With a group like this under his command, a corps commander need merely send his "L. G.". It could hold ground which armor or cavalry could not. It could support an infantry assault with infantry weapons. It would have the philosophy of infantry but be geared to speed. It would have the power to "find 'em, fix 'em, and finish 'em"—and could well be a major element in the United States Army's answer to its global responsibilities.

It seems fitting to consider here some adverse comments which have been made about the "Lightning Group." It has been said that at "normal" 50-yard intervals, road space would be excessive; that the ¼-ton truck will take the same road space in an extended column as does a half-track.

That was a valid objection in 1943. Later experience in Europe, however, discounted the need for such copybook rules. All types of vehicles operated with much less interval and generally closed up at the halts for control and mutual protection. With this unit, dispersion from halts or at slow speeds could be gained laterally to compensate for its vertical density. Also, the best defense against strafing is adequate antiaircraft fire that can be put up only when weapons are massed.

Comparable Losses

Suppose an armored infantry rifle company in half-tracks at 50-yard intervals and a proposed combat company in jeeps at 15-yard intervals were destroyed by a 500-yard enemy strafing run. Here are the comparative losses in men and matériel:

Armored Infantry (50 yards): 10 vehicles, 130 men (approximate), vehicles valued at $200,000, shipping weight of vehicles, 80 tons.

Combat Company (15 yards): 33 vehicles, 110 men (approximate), vehicles valued at $66,000, shipping weight of vehicles, 49 tons.

A second objection to the "Lightning Group" is that no reconnaissance would be provided; yet our experience taught us that the best reconnaissance was that provided by patrols from the front-line companies. The divisional reconnaissance battalion was roundly cursed by many a battalion and combat commander as being more in the way than anything else.

Other critics claim, "Many of the ¼-ton trucks would be badly overloaded." However, the Army is not taking full advantage of the jeep's wonderful potential until it has loaded four men and an automatic weapon or mortar on each one. A vehicle doing a less-than-capacity job is just as much a goldbrick as a shirking man and results in costly added production of vehicles, tires and gasoline, strain on transport facilities, and waste of critical road space.

Earlier I mentioned a staggering loss in tanks sustained by one of our companies. The reason behind that, and similar losses by the other companies, is interesting.

As the German front in France crumbled, the retreating enemy artillery and antitank units left one piece, very often a 50-mm. antitank gun, at strategic crossroads or wherever there was an enticing field of fire and safe method of escape. The piece nearest the Americans was serviced by its full crew which had its truck or Volkswagen near by.

Shoot and Run

Our columns were generally led by a jeep or two, a half-track, and then a platoon of tanks. When our tanks had come within range, the German gunners would get off one, two, perhaps three, rounds, then run to their transport and take off down the road to the next gun position to repeat their success.

Invariably we lost a tank and some men, often two tanks and occasionally three. Because we were never absolutely sure whether it was another of these situations or a genuine bit of resistance, we had to halt, make an estimate of the situation, deploy, "attack," and, finally, having discovered we were waging a fierce engagement with a forest, regroup and move on.

At the cost of one old gun, the Germans had destroyed one or more of our medium tanks, killed one or more of our men, injured others, and delayed our approach—a nearly perfect score, all things considered, for the Axis.

By contrast, I think that if a combat battalion had been acting as advance guard we could have pushed on faster with far fewer losses in men and matériel.

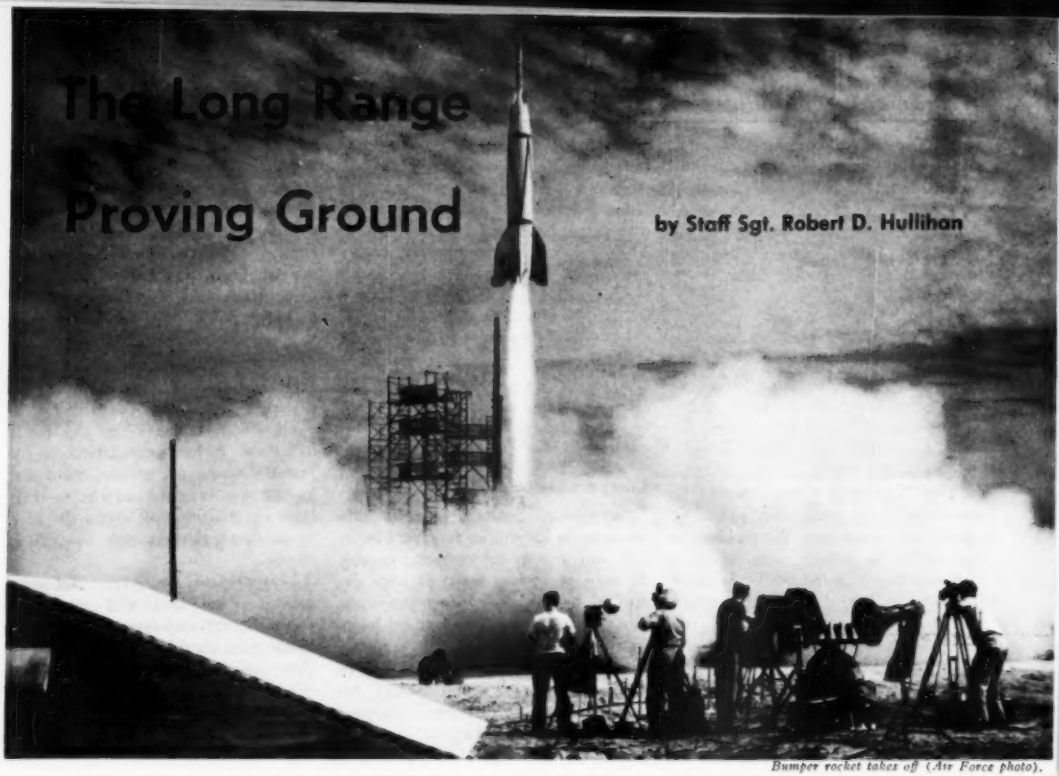
Jeeps Were Safe

Jeeps, to the uninitiated, may seem dangerous because of their lack of armor. Actually, as we found to our surprise and relief, and except where mines were concerned, they were about the safest of all vehicles. The flash of a gun or report of an explosion is all that's needed to bring a jeep to a sharp burst of speed and some fancy dodging or a sudden halt with the occupants flying out in all directions to seek cover in the soldier's best friend, the ditch.

For getting a job done quickly and with minimum casualties in men, vehicles, and equipment, I'll take the "Lightning Group"—will you?

The Long Range Proving Ground

by Staff Sgt. Robert D. Hullihan



Bumper rocket takes off (Air Force photo).

Rocket Test Site Can Be Extended for Five Thousand Miles

THE most evident proof that this Nation's guided-missile program is geared to what may be tomorrow's urgent need can be found today on a narrow strip of offshore land along the east-central coast of Florida. - - -

Here the Long Range Proving Ground Division of the United States Air Force, with headquarters at Patrick Air Force Base, Cocoa, Fla., has established the base and launching area of the world's most extensive guided-missile proving ground.

"Overseas Stations"

So great is the capacity of the Long Range Proving Ground that its establishment has involved the conclusion of international agreements, and its operation necessitates the assignment of personnel to what are considered to be overseas stations.

All-important natural features are basic in making the Long Range Proving Ground the only installation of its kind and the major guided-missile flight-test facility of all branches of our armed forces.

First, a flight-test range can be extended 5,000 miles from the Cape Canaveral, Fla., launching site southeastward over the Atlantic without crossing any large land masses. Secondly, the Bahama Islands, Puerto Rico, and other islands standing down toward the southeast provide locations for data-collecting observation stations along the first 1,000 miles of range.

Natural Characteristics

These natural characteristics counted strongly in determining the present location and today form the physical foundation upon which the Long Range Proving Ground Division is meeting the terms of its mission.

That mission, in brief, is to establish, operate, and maintain a long flight-test range and to provide all services and facilities required in the preflight and flight-testing of guided missiles which are passing through research and development stages.

Sergeant Hullihan is attached to Headquarters, Long Range Proving Ground Division, United States Air Force, Patrick Air Force Base, Cocoa, Fla.

Responsibility

Thus it has become the responsibility of the Long Range Proving Ground Division, commanded by Maj. Gen. William L. Richardson, U.S.A.F., to implement, man, and operate a field of trial which will be adequate for missiles of any potential and to collect the in-flight performance data so necessary in the development of standard weapons.

Col. Harold R. Turner, Ordnance rocket expert and a former commander of White Sands Proving Ground, N. Mex., is in command of the advance headquarters of the Long Range Proving Ground.

It is apparent that to be utilized fully in the national interest, the Long Range Proving Ground cannot be restricted to the testing of missiles under development by any one or only one

service. This never has been the conception of the use of the proving ground. In fact, as originally activated in October 1949, the proving ground was a joint operation of the Army, Navy, and Air Force. Though responsibility for the range was later delegated solely to the Air Force, the change did not disturb the idea of its joint use.

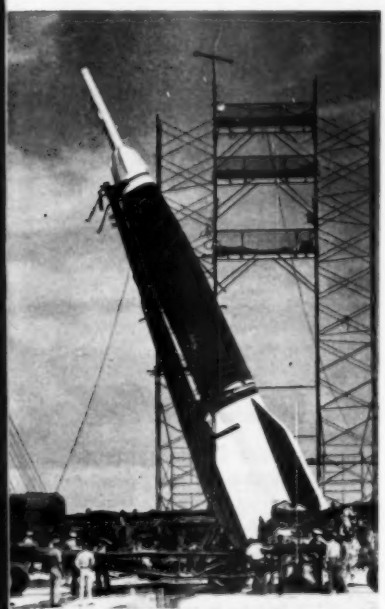
First Launching

For example, the first missile-launching at the proving ground, on July 24, 1950, was an operation involving the Army Ordnance Department, the General Electric Company, and the Air Force.

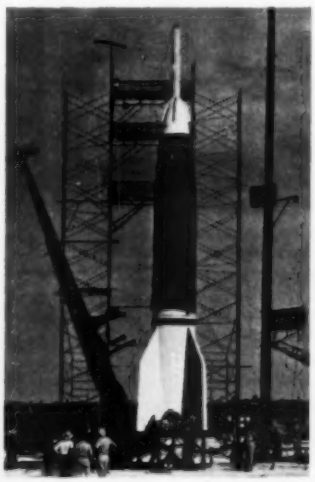
Since the date of that first launching the Long Range Proving Ground has been accomplishing the establishment and operation phases of its mission, concurrently maintaining a limited missile flight-test schedule while constructing permanent range installations.

The main stage for operation of the proving ground is a 12,000-acre tract of land on Cape Canaveral which has been purchased and cleared by the Government to serve as a safe and naturally secure launching area. Cape Canaveral lies about eighteen miles north of Patrick Air Force Base, the base facility serving the entire proving ground.

A 100-foot-square launching pad of reënforced concrete lies near the tip of the cape. From this point the flight-test range extends thousands of miles southeastward over the Atlantic. Construction now going on adjacent to this launching site includes a concrete blockhouse connected to the launching pad by a tunnel system, a central control station, two communications buildings,



A Meillerwagen is about to place a "Bumper" rocket on the launching platform after bringing it from the assembly area (Air Force photos).



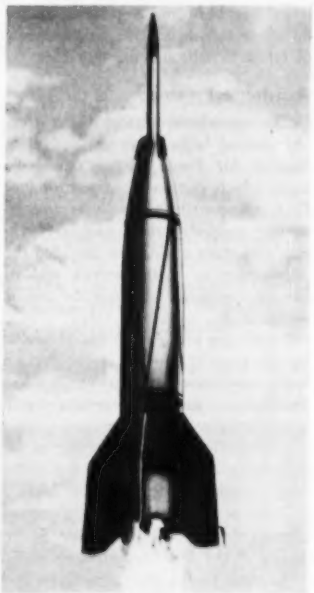
Here the rocket rests on the launching platform and will be made ready to fire.

and electronic interference control stations for monitoring radio frequencies used in flight tests.

The ocean test-flight range is being flanked with a series of instrumented observation stations known at the proving ground as operating subdivisions. Three of these subdivisions are now activated, the first on Cape Canaveral, the second on the Florida mainland at Point Jupiter just north of West Palm Beach, and the third on Grand Bahama Island.

The subdivision on Grand Bahama Island is approximately 150 miles southeast of Cape Canaveral, but the Point Jupiter installation answers the need for an observation station within the first lap of range.

Establishment of similar observation



The 2-stage long-range rocket in flight.

stations on Eleuthera, San Salvador, Mayaguana, Grand Turks, all in the Bahama Islands group, and on Puerto Rico, is now going on or is in the preliminary or planning stage.

As in the case of the instrumentation stations now active, all "down-range" bases will be manned by qualified personnel and equipped with the electronic systems capable of measuring the flight path of a missile on the range, of receiving data concerning its internal performance, and of exercising guidance and control over its flight. All operating subdivisions will be linked into a communications net of radio, land wire, and submarine cable.

Range Engineering

The directorate of technical operations of the proving ground, headed by Dr. Arthur H. Warner, an eminent physicist with an extensive military research and development background, is responsible for engineering the range and for operating the instrumentation and data-reduction systems necessary to acquire essential static and flight-performance data.

Construction of instrumentation stations in the Bahama Islands and assignment of military and civilian personnel

there has been made possible under an agreement with the Governments of Great Britain and the Bahamas.

Assistance Provided

The operational services of the proving ground begin with the arrival at Patrick Air Force Base of a missile from which certain flight-performance data is required. All facilities and assistance needed in the assembly, check-out, and static testing are provided the representatives of the service and its private contractor who have the missile under study.

Launching of the missile is scheduled by the proving ground in conjunction with continuous studies of climatic, atmospheric, and radio-reception conditions in the range area.

Transportation of the missile to the launching area, setup on the launching pads, check-outs, fueling, and launching are performed by proving ground personnel and facilities under supervision of the missile contractor.

In these preliminary procedures and through the missile-launching operation, guided-missile units assigned to the proving ground receive the training and experience which are important correlatives of the division's mission.

At a sufficient time prior to a scheduled launching, the proving ground begins range-clearance operations to insure the safety of private interests during the flight test. Determination is made of the area at sea where the missile to be launched will make impact, and a warning is issued to all agencies controlling or having knowledge of ship traffic which would normally be in that area during flight-test operations.

Some hours before launching range-clearance personnel begin an intensive sea and air search of the area within predetermined limits of danger. Radar-equipped planes search the range for ship traffic while ground radar stations in the launching area and along the flight line sweep for unwarned aircraft.

Ships Warned

"Polly" planes (equipped with loud speakers) fly low over surface ships to warn them out of the danger area; crash boats patrol the waters off Cape Canaveral and in the impact zone to ward off other small craft.

On the basis of reports from these search units, the range-clearance officer of the proving ground determines the safety of the range and authorizes the launching of the missile.

If a clear range coincides with the readiness of personnel and equipment in the launching area and in instrumentation stations down range, with the proper functioning of all parts of the missile and of the instruments it carries, and with climatic and radio-receiving conditions, the missile is launched.

When the missile is launched—by remote controls within the blockhouse—it becomes the responsibility of the in-flight safety officer. By means of automatic tracking radars slaved to a plotting board, this officer is constantly aware of the speed, altitude, location, and course of the missile as it passes down range.

Missile Destroyed

If the in-flight safety officer observes that the missile is deviating from course toward predetermined "destruct" lines within the range, or that it is performing erratically, he may order the transmission of a radio signal which will cause the missile to destroy itself in flight and to fall harmlessly to sea.

With the missile in flight down the range the second important phase of the Long Range Proving Ground's service comes into operation as instrumentation stations along the flight course begin to collect performance data. This is done principally by means of radar, optical-tracking instruments, and telemetering systems. A telemetering system consists of a small radio transmitter mounted inside the missile and equipped with a pick-up device which samples such phenomena as pressure, temperature, acceleration, and control movement.

This data is converted into an electronic voltage and transmitted to ground stations where it is reconverted to a usable physical quantity.

It is necessary that several phenomena within the missile be examined either in sequence or simultaneously so that the relationship of one occurrence to another may be known. For this reason samples of data must be taken at rates upward to 1,000 times a second while the missile moves down miles of range at supersonic speeds and altitudes usually greater than those flown by conventional aircraft.

With the return to a central point of all flight-performance data and its reduction to a form usable by the missile contractor, the proving ground has completed its primary function.

The history of the Long Range Proving Ground dates from 1945 when it became apparent that proving-ground facilities in the United States were inadequate even for the flight testing of guided missiles then on the scene.

On the recommendation of the Guided Missiles Committee of the Joint Chiefs of Staff that a new test area capable of containing long-range guided-missile test flights should be established, the problem was referred to the Joint Research and Development Board.

A committee on the Long Range Proving Ground was set up in October 1946 which started extensive surveys of possible sites. The committee unanimously recommended the Cape Canaveral launching area in a report submitted in June 1947. An executive group headed by General Richardson and formed within the Department of the Air Force then initiated negotiations for rights in the Bahama Islands, prepared enabling legislation, and made cost studies for appropriations. Enabling legislation was passed by Congress and the bill was signed by President Truman in May 1949.

Long Experience

As commander of the Long Range Proving Ground Division, General Richardson's experience in the field of guided missiles extends back to the winter of 1944 when his wartime command, the IX Air Defense Command of the Ninth Air Force in Europe, destroyed more than 2,000 "buzz bombs" launched by the Germans against the vital supply port of Antwerp.

Since that time, and throughout the history, establishment, and operation of the proving ground, General Richardson has become one of the leading military figures in guided-missile research and development.

Today, the Long Range Proving Ground is being advanced rapidly toward fully operational capacity which is expected sometime in 1952.

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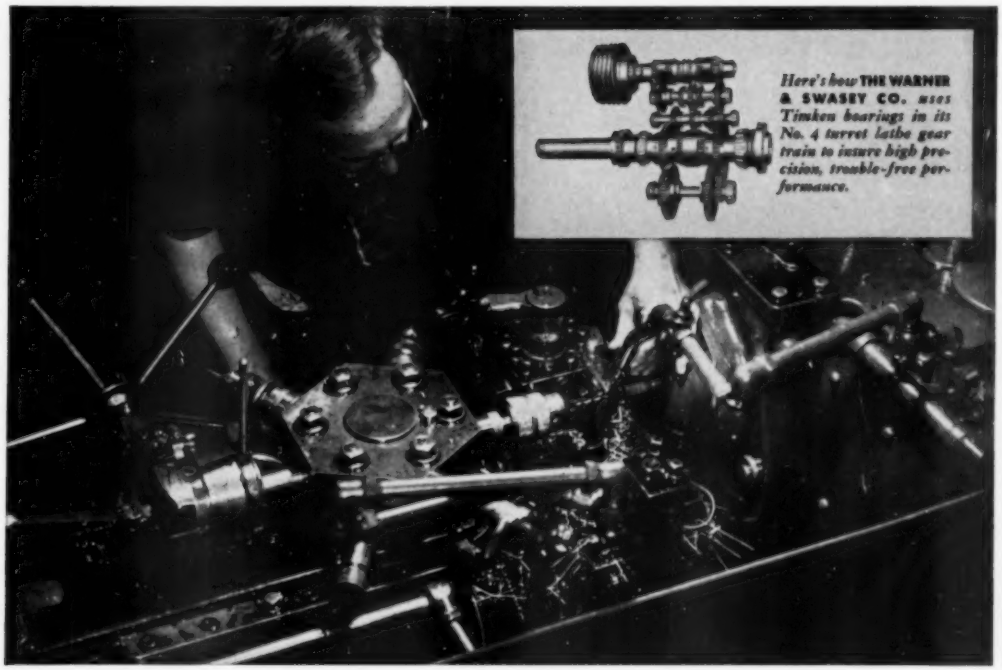

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Hal Harrison from National Audubon Society

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In addition to controlling predators like the Great Horned Owl, sportsmen can help preserve good hunting by working in local and national conservation programs. See your local game regulations, too, before shooting the Great Horned Owl.

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